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# Skeptical Inquirer

THE MAGAZINE FOR SCIENCE AND REASON

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## [ FROM THE EDITOR

# Cold Fusion to E-Cat: From Pathological Science to ... Worse

It is hard to believe three decades have passed. This March will be the thirtieth anniversary of cold fusion. In case you think that debacle—that icon of pathological science—is all in the past, think again. Two articles in this issue provide scientific perspective and report on a new related device. In "Cold Fusion: Thirty Years Later" chemistry professor David W. Ball (Cleveland State University) reviews what happened with cold fusion, what resulted, and how the entire series of events is viewed today. Was cold fusion a case of what is wrong or of what is right in science? Both, Ball concludes, but he says the balance is toward the latter: "Scientists ended up doing what scientists do: they tried to understand and replicate the work, and when not able to do so, said so and even criticized the original results. In the end science worked."

When the cold fusion claims broke, I was working at Sandia National Laboratories. As a major U.S. Department of Energy (DOE) national laboratory, Sandia was one of the leading labs DOE tasked with trying to figure out what was going on. I remember the excitement well. Some of Sandia's many PhD nuclear physicists, engineers, and research chemists immediately began devising ways to test cold fusion. Over the ensuing months they conducted a number of clever experiments. None I know of replicated the claims; many falsified them. Sandia prefers to avoid the limelight, so few of those experiments became widely known. Other labs elsewhere did their own studies, and some of those scientists did publicize their generally negative results. Gradually, cold fusion fell by the wayside.

To the degree cold fusion exists anymore, it is known now by a euphemism: low-energy nuclear reactions, or LENR (pseudosciences often change names). A few devotees still pursue it. One self-proclaimed inventor, Andrea Rossi, aggressively promotes his Energy Catalysis, or E-Cat, device. Like cold fusion's original proponents, he claims it generates nuclear energies on a tabletop. He demonstrates the machine to investors worldwide but is secretive about how all the black boxes composing it work. We have seen this before with perpetual motion machines. So we asked physics professor and SI author Sadri Hassani (Illinois State University) to investigate. His article, "Why E-Cat Is a Hoax," follows Ball's article.

Our two-article package is a lesson first for cold fusion in how science itself handles extraordinary claims when they seem important enough to justify the expenditure of major resources. (Scientists tend to ignore lesser popular claims, leaving groups like ours to respond.) Also see Hassani's comparison of the impacts that real scientific discoveries have had within thirty years of their publication. For E-Cat, it is a lesson in human credulity and conspiratorial thinking. Australian skeptic and entrepreneur (and CSI fellow) Dick Smith has offered Rossi a one-million-dollar challenge to demonstrate his E-Cat device before unbiased observers; Rossi declined. E-Cat has no scientific traction.

I write this just after our big CSICon 2018 conference on science and skepticism in Las Vegas. It was the largest CSICon yet and very exciting. Participants seemed exhilarated. We'll have a series of reports in our next issue.

—Kendrick Frazier

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## Fringe Scientist Santilli's Suit Against Dutch Astronomer Settled

Jan Willem Nienhuys

An American fringe scientist sued an innocent astronomer on the suspicion of being part of a Jewish conspiracy. His crime: having a colleague who made fun of a telescope that registered "invisible terrestrial entities." The lawsuit cost Dutch skeptics almost $300,000 to defend in a Florida court.

Ruggero Maria Santilli was born in 1935 about sixty miles north of Naples, Italy, where he attended university, becoming "Dottore" (Master) in physics on December 10, 1958. Subsequently he taught physics in two Turin high schools. Around 1966, he attended the School of Specialization in Nuclear Physics in Turin. There he supposedly obtained the "equivalent of a PhD"—though Italy had no formal PhD ("Dottore di Ricerca") before 1980. A recent search of the archives of Turin University found no trace of a specialization thesis by Santilli.

"Dr." Santilli then moved to the United States and held positions at several universities, lastly as research fellow at several prestigious universities, supported by unemployment benefits or Department of Energy grants under supervision of tenured professors. After 1981, he set up a one-man institute.

Initially, Santilli investigated a generalization of the so-called Lie product *AB-BA* to *AKB-BLA*. Supposedly this could describe processes where energy is lost, for example by friction. During his stay at Harvard, he applied this theory to nuclear physics and called it "hadronic physics." He thought that Einstein's relativity theory was not valid in dense objects such as atomic nuclei. He didn't believe in quarks either. Other physicists remarked that the hadronic theory violated basic principles such as conservation of energy and time symmetry of almost all processes of fundamental physics.

Prof. Ruggero Maria Santilli in June 2008

**Santilli's healthy sense of self-esteem made him think all this opposition was caused not by his own utter incompetence but by a conspiracy of fanatical criminal physicists who all happened to be Jewish.**

### 'You Have Zero Knowledge'

Santilli regretted that experimentalists did not want to test his wildly speculative theories. In reviews and referee reports of Santilli's work, we find phrases such as: "basically confused on physical issues," "borderline between being a third rate scientist and a crackpot," "works of Santilli are trivial, wrong, or no more than presentations of frameworks that he wishes to work," and "it is astounding that such nonsense as this can be promulgated." Santilli got hundreds of rejections. The fact that he wrote long letters after each rejection cannot have helped him very much; as in his all-caps 1979 message to Robert K. Adair, editor of *Physical Review Letters*: "YOU HAVE ZERO TECHNICAL KNOWLEDGE OF THE STUDIES OF LIE-ADMISSIBILITY, ZERO KNOWLEDGE OF THE STATUS OF FORMULATION OF EXPERIMENTS, AND ZERO KNOWLEDGE ON THEIR TECHNICAL AND HISTORICAL IMPLICATIONS."

Santilli's healthy sense of self-esteem made him think all this opposition was caused not by his own utter incompetence but by a conspiracy of fanatical criminal physicists who all happened to be Jewish and who supposedly tried to shield Einstein's theory from Santilli's efforts to broaden it. His 1984 book *Il Grande Grido* (*The Big Scream*) detailed his sorrows in almost 1,500 pages. In 1985, he was naturalized as a U.S. citizen.

During the 1990s, he extended his theories and even invented a new way of multiplying numbers. One should insert an extra multiplication with a time- and place-dependent factor whenever one multiplies two numbers (not operators such as *A* and *B*), so one times one equals four or whatever the inserted factor is. Numerous pages were dedicated to explaining this trick over and over again, rewriting the whole of mathematics.

### From HHO to Antimatter

Santilli's strange theories led him to invent a new magnetic, molecular bond, which supposedly occurred in a new powerful fuel named HHO, which doesn't need oxygen to burn. He also discovered cold fusion and how to deactivate radioactive nuclear waste, and he obtained neutrons from ionized hydrogen. He furthermore explained red sunsets as the effect of photons getting tired by passing through the atmo-

sphere. The same effect supposedly caused the redshifts of remote galaxies.[1] Santilli argued that the expansion of the universe was just a medieval geocentric idea, but he goofed up simple junior high school geometry. General relativity specialist Christian Corda had some sympathy with Santilli's theories and tried to explain to him why he was wrong. It earned him a sickening "denunciation" of the "outcast never-employed jewish physicist christian corda" and his role in "organized jewish scientific crime." Santilli claimed also he wasn't an anti-Semite at all—the familiar argument of the calling-me-an-anti-Semite-is-a-dirty-Jewish-trick type.

**Santilli's strange theories led him to invent a new magnetic, molecular bond, which supposedly occurred in a new powerful fuel named HHO, which doesn't need oxygen to burn.**

Santilli's "isodual theory of antimatter" amounted to putting an extra factor -1 into every multiplication, i.e., just interchange all pluses and minuses. Hence light from antimatter would be focused by negative, hollow lenses. Santilli seemed to be thoroughly confused about negative and positive, giving 0.74 as an example of a "negative" index of refraction.

Santilli had a simple commercial telescope fitted with a concave instead of a convex lens and took amateurish photographs with it. He thought it could detect "antimatter light." (But there is only one kind of electromagnetic radiation; in modern physics, matter and antimatter produce the same kind of light.) He found "antimatter galaxies" (in 2014) and even claimed to have observed (around the beginning of 2016) vague blotches that he interpreted as invisible terrestrial entities spying on America. He produced a video viewed 750,000 times showing that claims about seeing aliens or UFOs still attract attention.

### Enter the Dutch

Pepijn van Erp, a member of the board of the Dutch skeptics group Stichting Skepsis, had already been paying attention to Santilli's HHO gas claims and to the so-called independent scholar Jerdsey Kadeisvili, who had been defending HHO. Van Erp had convincingly argued that Kadeisvili was in fact just one of Santilli's pseudonyms. This Kadeisvili, incidentally, also wrote one of about twenty recommendations on Santilli's website that Santilli should get a Nobel Prize, and he also defended the antimatter telescope.

In 2016, van Erp wrote on his personal blog a 500-word item, captioned with typical Dutch directness, making fun of the Santilli telescope; this blog post scored quite high in Google searches for "Ruggero Santilli." This irritated Santilli. His plan of selling his telescopes to millions of American amateur astronomers didn't work out. He sold only three, all abroad. Santilli's wife, Carla, first asked Skepsis chairman and astronomer Frank Israel—who at that time was not aware of either Santilli or van Erp's blog post—to make van Erp change his blunt title (which cast aspersions on Santilli's mental acuity). When that didn't work, Santilli sued both Israel and van Erp for defamation. Santilli later claimed that he had incurred three million dollars in damages, both personal and as shareholder in his HHO and telescope companies. Curiously, the blog title wasn't objected to, but the concluding remarks were: "Is Santilli just a mad professor? Or is he a cunning scam artist trying to sell his 'Santilli-ofocus-scopes' (or even better: stock in his businesses) to people who fall easily for sciency sounding nonsense? Maybe both … ." Such rhetorical hyperbole, supported by arguments, is of course protected speech under the First Amendment.

### Bizarre U.S. Justice

Santilli later asserted that Israel was acting on behalf of an anti-Santilli conspiracy led by Nobel laureate physicist Steven Weinberg (a CSI fellow) and that he wanted to use the lawsuit to find out how the conspiracy operated. American friends warned Skepsis that not defending oneself in a U.S. lawsuit could be very risky, so Skepsis decided to pay for Israel's and van Erp's defense. Israel is a regular visitor to the United States, and it was deemed unacceptable that he should have any problem just because he was our chairman. Moreover, it was (wrongly) expected that this meritless case, heard in U.S. District Court for the Middle District of Florida, Tampa Division, by Judge Virginia Hernandez Covington, would be immediately dismissed.

In fact, after two years and at cost of almost $300,000 to defend against the suit, the case against Israel was dismissed August 17, 2018, and a month later the whole case was settled. Van Erp retitled his post to "Florida Genius Now Sees Invisible 'Entities,'" and Santilli promised that if he would try something like this again, the loser would pay all costs. They both agreed to no more legal actions against each other for anything that happened before the settlement date. (For more information, do an internet search for "settlement+santilli.") All of Skepsis's savings of thirty years were wiped out. We appealed to our benefactors, and more than 700 of them generously compensated for about half of the amount spent. Thus ended our adventure with U.S. justice, which is to us, I'm sorry to say, even more bizarre than Santilli's silly spyglass.

### Note

1. The cosmological redshift is basically a frequency shift of spectral lines, and red sunsets are due to scattering of blue light. Santilli claims that he has measured a tiny redshift of spectral lines at the time of sunset and sunrise, something

Jan Willem Nienhuys is a mathematician, formerly at Eindhoven University of Technology, and secretary of the board of the Dutch skeptics group Skepsis. He is a fellow of the Committee for Skeptical Inquiry.

# The New IPCC Report on Global Warming of 1.5°C

Amardeo Sarma

The Intergovernmental Panel on Climate Change (IPCC) special report released in October 2018 focuses on the impacts of global warming of 1.5°C above pre-industrial levels and considers four possible global greenhouse gas emission trajectories or pathways, including several that could potentially limit global emissions to 1.5°C. The report (available online at http://www.ipcc.ch/report/sr15/) also seeks to point out how to strengthen the global response to the threat of climate change.

The report confirms that anthropogenic global warming is happening and that global temperatures are already about 1°C above pre-industrial levels. It says that past emissions alone are unlikely to drive temperatures above 1.5°C, but both $CO_2$ and other greenhouse gas emissions that cause global warming need to be reduced to zero by 2050 to achieve the goal of limiting warming to 1.5°C. The call is to keep global warming to 1.5°C and not 2.0°C because the larger increase would have such severe implications on sea-level rises, loss of marine life from ocean acidification, and risks to health, food security, and water supplies, among other things.

A positive is that the report addresses UN Sustainable Development Goals (SDGs) and acknowledges that these depend on each other. It also shows four pathways to achieve this goal, both with and without an overshoot of the goal. Also, the report has brought together a wealth of information to draw from, and the authors elaborate on why they assess the situation as more serious than they did with AR5, the previous assessment report in 2014.

It becomes clear that the world and all countries are failing their target and need to do something.

At the same time, the report has shortcomings, of which I highlight three:

**The IPCC report seeks to point out how to strengthen the global response to the threat of climate change.**

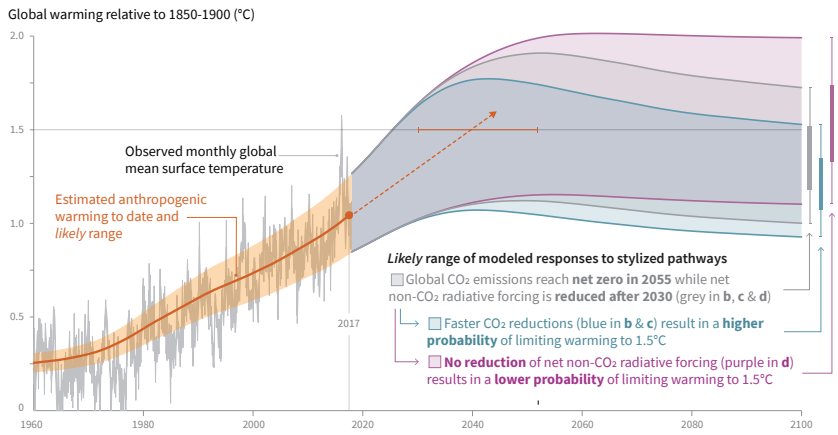
1. Two of four pathways assume a reduction of overall energy use, which would spell disaster for countries in Africa and Asia. World Bank data shows a clear correlation between the human development index and energy consumption. It is very unlikely that countries that plan to lift their citizens out of poverty will follow such a course, so these pathways are anything but realistic. Reducing energy use does not match the IPCC goals of being in line with addressing SDGs despite tables in Chapter 5 that indicate otherwise. It is unlikely that this proclaimed trade-off between SDGs and less energy use will withstand scientific scrutiny.

2. While all research on carbon capture and storage (CCS) and bio-energy with carbon capture and storage (BECCS) is welcome, the report shows an almost naive confidence in how BECCS—currently a technically immature and commercially hardly viable technology—can play a significant role in achieving negative emissions and thus be a major cornerstone of climate change mitigation.

3. The overall report is partisan when

**Cumulative emissions of $CO_2$ and future non-$CO_2$ radiative forcing determine the probability of limiting warming to 1.5°C**

**a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways**


Global warming relative to 1850-1900 (°C)
2.0
1.5
1.0
0.5
0
1960
1980
2000
2020
2040
2060
2080
2100
2017
Observed monthly global mean surface temperature
Estimated anthropogenic warming to date and likely range
Likely range of modeled responses to stylized pathways
Global CO2 emissions reach net zero in 2055 while net non-CO2 radiative forcing is reduced after 2030 (grey in b, c & d)
Faster CO2 reductions (blue in b & c) result in a higher probability of limiting warming to 1.5°C
No reduction of net non-CO2 radiative forcing (purple in d) results in a lower probability of limiting warming to 1.5°C

it comes to mitigation. It has a pro-renewable and antinuclear bias, the latter bordering on fearmongering. An example is this statement in a table of Chapter 5: "Increased occurrence of childhood leukaemia in populations living within 5 km of nuclear power plants was identified by some studies, even though a direct causal relation to ionizing radiation could not be established and other studies could not confirm any correlation (low evidence/agreement in this issue)." Such an assertion is very far from a consensus view and should normally have no place in a consensus report.

**The report confirms that anthropogenic global warming is happening and that global temperatures are already about 1°C above pre-industrial levels. It says that past emissions alone are unlikely to drive temperatures above 1.5˚C.**

We have known since the late 1970s that we have a problem. The Charney report showed in 1979 that a doubling of $CO_2$ would cause increasing global temperatures by about 3°C, an assessment that has not changed much since then. However, it was not clear how fast this would happen and how sluggish the response would be. James Hansen then showed in 1988 that the climate had already started changing and that the problem was imminent. Since then, IPCC has, based on a great deal of scientific literature, consolidated and consistently added state-of-the-art meat to these estimations, including pointing to the very varied regional effects.

The time to act is certainly overdue, and the new IPCC report is just one more reminder. It has excellent summaries regarding the status of climate change itself. However, the report does not offer good guidelines on how to respond to the challenge.

Governments will have to make bold decisions, and we certainly do not have the luxury of being able to choose between the mitigation alternatives of solar, wind, nuclear, CCS, or BECCS. For one, we cannot disregard the experience with the fastest decarbonization rates we have experienced so far with nuclear power in countries such as France and Sweden. The IPCC has done no dedicated reports on nuclear energy as they have for renewable energy, such as their IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. It is, however, a sign of hope that the IPCC also suggests an up to fivefold increase in nuclear power deployment for the more realistic pathways P3 and P4 and that it has not yet fully bowed to pressure groups.

I am even no longer sure that these reports change anything. There is more than enough evidence out there on climate change, even if some of the latest nitty-gritty details need further research. There have been plenty of IPCC reports, and they do provide very useful information, but they have not led to any useful action. Emissions continue to rise. Governments and other relevant players must be held responsible. It is their job to mitigate and adapt to climate change, and they cannot delegate this responsibility to the IPCC by asking them to write yet another report.

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## Social Media–Fueled Child Abduction Rumors Lead to Killings

Benjamin Radford

Misinformation is always problematic but can be especially malicious in the digital age, when social media widely shares conspiracy theories and baseless rumors. In 2014, for example, a social media message claiming that salt water can cure or prevent Ebola went viral, causing illness and deaths in West Africa. A hoax text shared throughout Nigeria and Sierra Leone urging people to bathe in—and drink—salt water was created by a female student in Nigeria and was apparently intended as a joke. Because of the heightened fear at the time of the dreaded disease, at least two people died and dozens were sickened when they and their families followed the bogus "medical" advice.

In July 2018, rumors spread on the WhatsApp social messaging platform—owned by Facebook—became so toxic that India's Minister of Electronics and Information Technology, Ravi Shankar Prasad, issued a statement to the company that "The use, abuse, (and) misuse of your platform, particularly, which leads to killing of innocent people is plainly not acceptable."

So far in 2018, at least twenty people have been killed in separate incidents across a dozen Indian states when mobs set upon suspected child abductors they'd been warned about in messages on social media. According to a July 8 CBC News article by Simi Bassi and Joyita Sengupta:

> Three men at a railway station in the northeastern district of Assam were rescued by the army from a possible lynching. They were surrounded by hundreds mistaking them for possible child abductors. ... The men were begging for alms and at one point, appeared to have been speaking to a child. *The Times* spoke to an officer from nearby Pimpalner village, charged with the investigation. "Although there was no child kidnapping case recorded with Pimpalner police, there was

> a rumor in the village and its surrounding areas about an active child kidnapping gang," he said. "This is a tribal area, and any stranger or outsider is viewed with suspicion."

A July 18 news story on National Public Radio by Lauren Frayer (https://tinyurl.com/yam8k9rj) told the story of Iram Sabah, a mother of two young children who lives in Malegaon, in northern Maharashtra state, with her husband Shaikh Wasim Shaikh Karim. One night they heard a commotion in the streets; Shaikh Karim said, "I saw a mob beating five people. The crowd was getting bigger and bigger. They filled up the road in front of my house. They even attacked police vehicles." Frayer notes:

> The five victims at the center of the mob were a couple, their toddler and two relatives. They'd wandered into town to beg, police and witnesses said. Locals feared they were the kidnappers all these WhatsApp messages had warned of—and attacked them. Shaikh Karim pulled the victims to safety inside his home, as the mob shattered his windows with stones. Police finally intervened and extracted them.

In response to the attacks, WhatsApp founder Govindraj Ethiraj issued a statement duly condemning the violence and promising to renew efforts to curb the rumors—including hiring a group called Boom Live to trace and debunk the stories—while noting that ultimately any crimes committed by individuals are a police matter.

In some cases, deaths are directly attributable to a series of astonishingly poor decisions. The first was the creation of a poorly conceived public service announcement video depicting two men on a motorcycle menacingly circling a young boy walking along a street. The short video shows the men grabbing the boy and taking off. The video was posted to remind parents and children to be vigilant, but it was intentionally stripped of its context by unknown persons who edited out the ending—in which one of the would-be "kidnappers" holds up a sign for the camera reading, in part, "It only takes a moment to kidnap a child from the streets of Karachi."

**TIMELINE: DEATHS LINKED TO WHATSAPP RUMOURS IN INDIA**

**FEBRUARY**

- A migrant worker is lynched in Uttar Pradesh after being suspected of kidnapping

**APRIL**

- A man in Tamil Nadu was killed after being seen wandering aimlessly through the streets

**MAY**

- A man with mental health issues was killed after being accused of being a member of a kidnapping gang in Hyderabad
- A 55-year-old woman was lynched after offering sweets to children
- A man in Andhra Pradesh is lynched after speaking Hindi, not the local language, Telugu
- A transgender woman was killed in Hyderabad by angry locals suspecting her of being a child trafficker
- A man in Bangalore is tied up and beaten to death by a mob with cricket bats

**JUNE**

- Two men travelling in a SUV were killed in Assam after stopping to ask for directions after villagers spread rumours that they were hiding a child in the vehicle
- An activist hired by the state of Tripura to drive around with a loudspeaker and warn communities of fake rumours was killed by a mob, along with two others
- A merchant in Tripura is murdered by a 300-person mob after selling goods in the state for 20 years
- A beggar woman is killed after she and two others are beaten with sticks in Gujarat
- A rickshaw driver in Hyderabad is killed after being mobbed in front of his home after a social media rumour

**JULY**

- Five men are killed while visiting a neighbouring rural district in Maharashtra

Source: CBC News

The video was then posted to WhatsApp and circulated widely on social media, spurring people to be watchful for what they thought was (and what was portrayed to be) real footage of child abductors. Two men who stopped on a street to ask for directions were mobbed and beaten to death by people who suspected them of being the (non-existent) child abductors seen in the staged video.

The child abduction rumors spread to other countries as well. On August 29, 2018, Ricardo Flores and his uncle Alberto Flores Morales visited San Vicente Boqueron, Mexico, from their nearby hometown in their SUV to buy construction materials. They parked near a school and went into a local bar, arriving just as internet rumors on WhatsApp called for people to be vigilant for *extranjeros* (stranger) child kidnappers in the neighborhood driving an SUV. Villagers noticed the pair as not being local and accused them of looking for children to abduct. Their pleas of innocence were ignored as a mob dragged the men into the road, tied them up, beat them, and eventually burned them alive with gasoline outside a local police station.

In Gillitts, South Africa, an unidentified woman posted a voice message using WhatsApp for parents saying that a young child had been abducted at the Gillitts Primary School. She had arrived to pick up her children and heard a commotion nearby. According to Steven King, a coordinator with the South African Community Crime Watch:

> She then saw a man with a brown jacket running. She made sure her children were safe and left without looking to see what happened next. She states that with all the messages on social media about children being kidnapped she became extremely anxious and sent out a voice note warning parents of the impending danger at the school.

Officials investigated and children disputed the mother's account, saying that the "kidnapper" was in fact a security officer running in a field to help a child who had wandered off. The woman later apologized, and the South African Police Service issued a statement asking people not to create or share unconfirmed rumors on social media.

Benjamin Radford is deputy editor of Skeptical Inquirer and a member of the American Folklore Society.

## UK eHarmony Ads Banned for False Claims of Science

Benjamin Radford

In January 2018, Britain's Advertising Standards Authority (ASA) banned advertisements by online dating service eHarmony that claimed it uses a "scientifically proven matching system."

eHarmony is perhaps the best-known dating service claiming to mix science with seduction. According to the company's website, its marriage profile, "developed by a team of clinical experts … is rooted in classical psychometric theory—which uses well-established standards to measure mental abilities and traits in a reliable way."

eHarmony makes many claims about the scientific validity of their matching program, which they call a "Compatibility Matching System." eHarmony's claims to science and scientific validity are both explicit and implicit throughout the company's literature. A representative from eHarmony told me explicitly that "eHarmony's matching system was developed using an empirical, scientific process."

**Neil Clark Warren, the relationship expert behind eHarmony, has never published a single study on his company's magic matching algorithm.**

eHarmony
SINGLE
Already a Single Member? Login Here
TOUR
WHY EHARMONY
SUCCESS STORIES
SIGN UP
Why eHarmony | Scientific Matching | 29 Dimensions of Compatibility | Expert Guidance
Scientific Match Making
Out of all the single people you will meet in your life, only a very few would make a great relationship partner for you. Some singles aren't attractive to you. Others aren't ready for a relationship. Of the rest, many are great people who you might enjoy chemistry with initially, but they aren't compatible with you in the important ways that make long-term dating and relationships work. That's where eHarmony comes in. By combining the best scientific research with detailed profiling of every member, we screen thousands of single men and single women to bring you only the ones that have the potential to be truly right for you.
Compatibility Science
Based on his 35 years of marriage counseling and studies of thousands of married couples, eHarmony founder Dr. Neil Clark Warren exhaustively researched what makes marriages succeed and fail. His findings? Chemistry is not enough. Almost all marriages start out with good chemistry, yet 3 out of 4 couples end up unhappy or divorced.
Why Compatibility? Chemistry is Not Enough!
By studying the difference between happy and unhappy married couples, Dr. Warren's team of researchers found 29 Dimensions® that help predict great relationships. These compatibility dimensions include:
Core traits like emotional temperament, adaptability, curiosity, and intellect
Values and beliefs, such as spirituality and feelings about children
Relationship skills, such as conflict resolution
Making the Science of Compatibility Work for You
eHarmony provides an excellent service specifically for singles looking for love that lasts. Our Compatibility Matching System® matches you by taking into account the 29 Dimensions® of Compatibility that help predict the potential for relationship success. The results are single matches unlike anything you will find anywhere else. Our goal at eHarmony is to be more than a dating service to you. We want help you find the love of your life.
Join Now
Teresa and Vipul
Married: Sept. 25, 2004

The ASA investigated eHarmony's claims and found no evidence that its customers benefitted from any science-based superior matching and that its claims were "misleading." According to an article in *The Independent*:

> The complaint that triggered the ruling was lodged by Lord Lipsey, the joint chairman of the All Party Parliamentary Group on Statistics and a former lay member of the ASA council. "Phrases like scientifically proven should be confined to claims that are just that, not used in crude puffery designed to lure in those longing for love," said Lord Lipsey. "This is a new form of fake news which the ASA has rightly slapped down." (https://tinyurl.com/ybx4xvnm)

The ASA reviewed documentation provided by eHarmony about its "scientific methods" and concluded—just as I did in 2014—that none of the studies proved that eHarmony's system offers matching that is either based in valid science or matches clients at rates higher than its competitors. eHarmony later issued a statement saying it respectfully disagreed with the ASA but would "work with them to assure that our advertising is as clear as possible." ■

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# Could Multiple Personality Disorder Explain Life, the Universe, and Everything?

ROBERT STERN

Authors Bernardo Kastrup, Adam Crabtree, and Edward Kelly posed the above question as the title to their June 18, 2018, online article on multiple personality disorder (MPD), suggesting that MPD (now known as dissociative identity disorder [DID]) "might help us understand the fundamental nature of reality."[1] To prove the reality of MPD, they presented a case study of a woman with ten personalities, some of whom were blind and some of whom could see.[2] As further proof of the reality of MPD, they cited a brain imaging study purporting to show that MPD/DID patients had different patterns of blood flow during "emotional" and "resting" states when compared to healthy controls.[3] Things went downhill from there.

Making the illogical leap into New Age philosophy, they went on to write that the above-mentioned patient's hysterical blindness was "a compelling demonstration of the literally blinding power of extreme forms of dissociation which gives rise to multiple, operationally separate centers of consciousness, each with its own private inner life," and from there they argued that "this has important implications for our views about what is and is not possible in nature." It wasn't long before quantum physics and consciousness were tossed in, along with "constitutive panpsychism," "cosmopsychism," "idealism," and universal consciousness, resulting in several paragraphs that could only be described as incomprehensible, although the term *word salad* had been suggested.

**To prove the reality of MPD, the authors presented a case study of a woman with ten personalities, some of whom were blind and some of whom could see.**

Normally, articles of this sort—Chopra-esque—are ignored by anyone with more than a freshman's knowledge of either physics, philosophy, or psychology. However, this blog was published on the website of *Scientific American*(!), so a response is required. First, to the authors' proof of MPD:

1. Despite the MPD patient's subjective claims of blindness or sightedness (depending on the personality), the objective findings were basically normal. This diagnosis is known as functional blindness to ophthalmologists and as a conversion syndrome (hysterical blindness) to psychiatrists. There was a reason the ophthalmologist referred the patient to a psychiatric clinic—and it wasn't due to physical (cortical) blindness.

2. The fMRI study on switching "states" of MPDs and control subjects was beset with flaws, the most obvious being that all the MPD patients were on psychotropic medications at the

time (though none of the medications or doses were listed). The controls were not. Psychotropic medications (anti-depressants, mood-stabilizers, anti-psychotics, and stimulants) all change cerebral blood flow. In addition, this change in blood flow patterns during emotional switching is also seen in other diagnoses as well, most notably borderline personality disorder.

The matters of quantum physics and philosophy must be left to those who actually understand those things, but the research on MPD patients would certainly contradict the foolish notion that MPD would ever help anyone make sense of life, the universe, and everything. Starting with the obvious: MPD is a psychiatric disorder. Those who have been diagnosed with MPD suffer from the same erratic and impulsive symptoms as those with borderline personality disorder: unstable and intense relationships that usually end very badly, self-damaging behaviors due to impulsivity (reckless driving, drug abuse, reckless sex, etc.), recurrent suicidal behaviors or gestures, emotional instability, inappropriate and intense anger. The Minnesota Multiphasic Personality Inventory (MMPI), one of the better diagnostic tools, shows the same pattern for both. It has often been suggested that MPD is simply a variation of borderline personality disorder.

**Making the illogical leap into New Age philosophy, they went on to write that the a patient's hysterical blindness was "a compelling demonstration of the literally blinding power of extreme forms of dissociation ..."**

If the symptoms of MPD sound horrible, the prognosis is no better; numerous psychiatric hospitalizations due to suicidal depression, inability to function in society, inability to hold down a job or enjoy a sustained relationship with another, intensive outpatient services, and decreased social functioning. Many if not most people with MPD are deemed mentally disabled, and as a group they have a higher risk of mortality than the population as a whole.[4] If these patients hold the secret to life, the universe, and everything through their blinding power, then in the words of Samuel Goldwyn, "include me out."

So "could multiple personality disorder explain life, the universe, and everything?" The short answer is no. ■

## Notes

1. https://blogs.scientificamerican.com/observations/could-multiple-personality-disorder-explain-life-the-universe-and-everything/
2. https://www.researchgate.net/publication/282871198_Sight_and_blindness_in_the_same_person_Gating_in_the_visual_system?_sg=Z9giQKN_GxIPFe9d7-g5ct1O8YGBrNGlxvVnaQJjPiEj4_uzTyULJy4WQDMyk-k5ijh2CiMwGCT5zJCo
3. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0098795
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4055615/

Robert Stern is a retired psychiatrist living outside Ames, Iowa. He previously wrote "Trauma and Taboo" about traumatic therapy and the return of repressed memories in our May/June 2018 issue.

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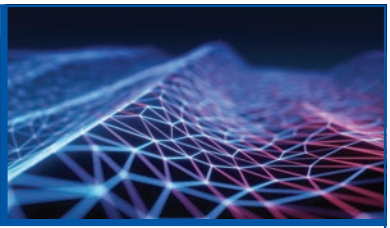

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Joe Nickell, PhD, is CSI's senior research fellow. This year, 2019, is the fiftieth anniversary of his becoming an investigator of the world's strange mysteries.

# Kraken: Monster of the Deep

The Kraken—a massive sea monster—legendarily rose out of the ocean to pluck sailors off ship decks or even to grasp whole vessels and carry them to the depths. It has sometimes been linked to the biblical Leviathan (e.g., Psalm 104:26; Isaiah 27:1) and the "world-serpent" of old Norse tales, Jormungandr. It was so large, some said, it could be mistaken for an island. It was a fitting subject for Tennyson's apocalyptic sonnet, "The Kraken" (1830):

> Below the thunders of the upper deep,
>
> Far, far beneath in the abysmal sea,
>
> His ancient, dreamless, uninvaded sleep
>
> The Kraken sleepeth ... .
>
> (Leach 1984, 589; Levy 1999, 18–23).

It is now clear that accounts of the multi-appendaged creature best describe the giant squid, although it is only a fraction of the length attributed to the mythic beast. The giant squid's genus is *Architeuthis*, and there is only a single species. (An even larger squid—*Mesonychoteuthis* or the colossal or Antarctic squid—exists, but its range is roughly south of the tips of South America, Africa, and New Zealand [Dockett 2017; "Colossal" 2018].)[1]

Despite the identification of the Kraken as the giant squid, however, there remains much to investigate—both about the maximum size of the actual creature and the accuracy of some accounts that may be greatly exaggerated or even outright fictional.

**It is now clear that accounts of the multi-appendaged creature best describe the giant squid, although it is only a fraction of the length attributed to the mythic beast.**

### Encounters

My interest in the legendary Kraken was renewed on a trip to the Canadian province of Newfoundland and Labrador in 2008, courtesy of the *MonsterQuest* TV series to investigate Lake Crescent's purported "giant eel." (It proved to be, most likely, otters swimming in a line [Nickell 2009].) In the course of my further travels in the province, I learned of giant squid along the Newfoundland coast. I was subsequently one of the "stars" (cast) of the "Kraken" episode of Animal Planet's popular *Lost Tapes* TV series in 2010.

Historically—following specimens that were sighted or stranded at Denmark in 1545, Iceland in 1639, and Ireland in 1673—the first in North American waters was reported at Newfoundland's Grand Banks in 1785 (Ellis 1994, 125, 126, 130; Ellis 1998, 257). Other reports eventually followed.

In October 1873, two fishermen and a boy in a rowboat in Conception Bay, Newfoundland, came upon a dormant floating object. Suddenly, a terrible creature came to life and fastened one tentacle to the boat while another encircled it and pulled so that water began to pour inside. Twelve-year-old Tom Piccott had the presence of mind to grab up a "tomahawk" from the bottom of the boat and chop at the estimated thirty-five foot tentacle. When he had hacked it off, he did the same with the other attached to the little boat, and the creature retreated into the ocean while emitting an inky fluid to obscure its trail.

Tom took the longer piece of tentacle to St. John's to a Presbyterian minister and amateur naturalist named Rev. Dr. Moses Harvey who had long been fascinated by tales of the "Devil Fish."

He paid Tom ten dollars for the monstrous tentacle, later recalling:

> How my heart pounded as I drew out of the tub in which he carried it, coil after coil, to the length of nineteen feet, the dusty red member, strong and tough as leather, about as thick as a man's wrist. I knew at a glance it was one of the tentacles or long arms of the ancients' Kraken, or modern giant cuttle fish. Eureka! (Harvey 1899)

Harvey's interest and expertise led him to further luck. Just three weeks later he was called to Logy Bay where an almost complete specimen had been brought, entangled in some fishermen's net. As they tried to drag the net to shore, tentacles extending through it tried to grasp the boat, whereupon one man drew his splitting knife and severed most of the creature's head. Of course Harvey bought this specimen too, took it home in his wagon, and stored it in brine in his shed. Although this creature was smaller than the previous one, its tentacles measured up to twenty-four feet.

Harvey presented his giant squid specimens and papers to Yale University professor A.E. Verril, an authority on cephalopods. Four years later, a severe windstorm drove another giant squid ashore at Catalina, and it was acquired by the New York Aquarium for $500. Still other encounters and specimens proliferated (Fitzgerald 2006, 49–71).

#### Attack on a Schooner

As striking as these encounters are, it was the giant squid's attack on a 150-ton schooner in 1874 that reportedly spilled—not squid "ink" but copious printing ink in newspapers throughout Canada and the United States. My source cited testimony of both many survivors and witnesses from a nearby ship, the *Strathowen*. Supposedly the schooner, the *Peril*, had been in Atlantic waters to the south of Newfoundland.

Suddenly a gigantic creature rose from the sea and wrapped its tentacles around the *Peril*. Captain James Flood later told how he had grabbed up his rifle and—despite Newfoundlander Bill Darling's warning not to shoot and so enrage the huge creature—did just that. "The oblong body," he said, "was at least half the size of our vessel in length and just as thick. The train must have been a hundred feet long." Although the men assailed the monstrosity with axes, it pulled the craft over and dragged it beneath the waves. The *Strathowen* moved in then and rescued the captain and his surviving crew members.

**It was the giant squid's attack on a 150-ton schooner in 1874 that reportedly spilled—not squid "ink" but copious printing ink in newspapers throughout Canada and the United States.**

To learn more, I followed my source (Fitzgerald 2005, 74–76) to *his*, an account by Edward Rowe Snow in Snow's *Mysteries and Adventures Along the Atlantic Coast* (1948). To my consternation, *Peril* is there named as "*Pearl*" and Capt. Flood as "Floyd," the location of the encounter is not given, and the creature is described not as a squid but as "a giant octopus"! Moreover, the original news source is not Fitzgerald's *News World* but instead "*News of the World* for July 5, 1874."

Seeking to verify the story and to document the facts, I set Google on the trail and in time was led from waters south of Newfoundland across the Atlantic and around the tip of Africa to the Indian Ocean's Bay of Bengal! From there, in June 1874 reportedly, accounts supposedly appeared in Indian newspapers about an attack on a 150-ton schooner—accounts whose text was nearly identical to the foregoing.

In fact, the publishing trail soon led to *The Times* of London, where intrepid CFI Libraries Director Tim Binga was eventually able to secure a digital copy of the story, titled "A Successor to the Sea Serpent," which appeared in *The Times* of July 4, 1874, on page 8. However, it had in turn been taken from the *Homeward Mail*, a British paper in India, and we soon had that text of Monday, June 29, 1874, in hand.

The *Homeward Mail*'s account is appropriately headed, "A Very Strange Story," and purports to tell how some unidentified person aboard the steamer *Strathowen*, having witnessed the attack on the schooner, "prevailed on the skipper," after his rescue, "to give me his written account." That follows in quotation marks and is signed, "James Floyd, late master schooner *Pearl*."

#### Truth Be Told

But is this story true? I immediately found it very doubtful, but some others have accepted it. The authority on the giant squid, Richard Ellis (1998, 257–265), includes it in his list of 121

"Authenticated Giant Squid Sightings" (1545–1996); however, his source is at a century's remove. Fitzgerald (2005, 74–76) insists of the attack on the schooner, "This attack was not imaginary"; and yet we have seen that he thought it occurred off the Newfoundland coast, and his source was also untrustworthy (Ellis 1998).

No less a figure than Arthur C. Clarke wrote of *The Times* account, "If you think this an improbable story, I do not blame you; I would not take it very seriously myself, if it had appeared anywhere except in the shipping column of *The Times*—a paper not noted for sensational journalism" (Clarke 1974). However, as we have seen, it did first appear somewhere else, in a source lacking *The Times*' reputation, *Homeward Mail*, which said it had in turn been "communicated to the Indian papers." By whom is not stated, so the original remains unknown—three or so steps back from *The Times*. I feel sure that if Clarke had known all this he would not have given his endorsement—equivocal though it was.

The evidence regarding the credibility of the tale is bad indeed. There is no record of a ship named the *Strathowen* in Loyd's Register or other source, and a review of the account more recently (Boyle 1999) laments, "It is unfortunate that the facts concerning the encounter in question have never been wholly substantiated."

Moreover, the Bay of Bengal, the northern extension of the Indian Ocean, is not a known habitat of giant squid, based on the locations of beaches they have washed up on. They are rarely found in the tropics (Smithsonian Ocean 2018).[2]

From what we know of the giant squid, such an attack as that alleged on a 150-ton schooner would not seem credible. The largest specimen known was only fifty-nine feet long and weighed just under a ton—being a female, which is typically larger than the male ("Giant Squid Facts" 2018). Regarding old sailors' tales of giant squids overpowering ships or snatching someone from deck or shore, advises one source, "None of these turn out to be true" ("Giant Squid Found" 2007).

That the writer is not only anonymous but avoids telling us whether he is a reporter or other communicant is suspicious, as is the introductory phrase that the story "has been communicated"—the passive-voice construction aiding in the concealment of the author. And of course the existence of "Captain James Floyd" likewise remains unverified and questionable.

"Floyd" certainly seems to have missed his true calling—not as a ship's captain but as a spinner of adventure yarns. He reproduces dialect, having one crewman state, "and it ain't the sea sarpent, for he's too round for that ere critter." His attention to detail is admirable: he notes that three of the crew "had found axes, and one a rusty cutlass." He describes "the advancing monster" as "a huge oblong mass moving by jerks just under the surface of the water." Then, he says, "In the time I have taken to write this the brute struck us, and the ship quivered under the thud; in another moment, monstrous arms like trees seized the vessel and she heeled [tilted] over." I suspect "Floyd" is the invention of the anonymous author.

The concocted narrative may have been inspired by a similar episode in Jules Verne's novel *Twenty Thousand Leagues under the Sea* published in 1869. In it a giant poulp (a cephalopod such as an octopus or squid) has become entangled in the *Nautilus*'s screw, and Captain Nemo raises the submarine to the surface. Opening the hatch, he and the crew use axes to battle, not just one creature but, over a quarter hour's time, ten or twelve from a "nest of serpents, that wriggled on the platform in the waves of blood and ink." (One of the crew is Ned Land, a Canadian, who may have been the model for the *Pearl*'s Bill Darling, a Newfoundlander.)

## Conclusions

Beyond mythology and fantasy, the Kraken of old is of renewed interest as the giant squid (*Architeuthis*)—diminished in size but authentically real. Even at "only" sixty feet, it rivals the sperm whale for length, and we do not really know how large it may get. Richard Ellis, in his definitive book (1998, 8), states: "It is the least-known large animal on earth, the last monster to be conquered." ■

## Notes

1. Squid have *eight arms*, which have suckers along their entire length, and a *pair of longer tentacles*, with suckers only at the tip.

2. A list of squid sightings and strandings (Ellis 1998, 257–264) lists only two for the Indian Ocean: one the questionable *Pearl* story and one other, the following year, in the Southern Indian Ocean, of "unknown" size.

## References


Boyle, Richard. 1999. When the squid sank a schooner. *The Sunday Times* (December 12).

Clarke, Arthur C. 1974. *The Treasure of the Great Reef*; quoted in Boyle 1999.

Colossal Squid. 2018. Available online at https://en.wikipedia.org/wiki/Colossal_squid; accessed September 6, 2018.

Dockett, Eric. 2017. Colossal Squid vs. Giant Squid: The Real Kraken Sea Monster. Available online at https://owlcation.com/stem/Colossal-Squid-vs-Giant-Squid-the-Real-Kraken-Sea-Monster; accessed September 6, 2018.

Ellis, Richard. 1994. *Monsters of the Sea*. New York: Alfred A. Knopf.

———. 1998. The *Search for the Giant Squid: The Biology and Mythology of the World's Most Elusive Creature*. New York: Penguin Books.

Fitzgerald, Jack. 2005. *Ghosts and Oddities*. St. John's, NL Canada: Jefferson Publishing.

———. 2006. *Newfoundland Adventures*. St. John's, NL Canada: Creative Publishers.

Giant Squid Facts. 2018. Available online at www.softschools.com/facts/animals/giant_squid_facts/113; accessed September 18, 2018.

Giant Squid Found. 2007. *Monster Quest*, Season 1, Episode 3, originally aired November 14.

Harvey, Rev. Moses. 1899. A Sea Monster Unmasked. *Science Digest*. Cited in Fitzgerald 2006.

Leach, Maria, ed. 1984. *Funk & Wagnalls Standard Dictionary of Folklore, Mythology, and Legend*. New York: Harper & Row.

Levy, Joel. 1999. *A Natural History of the Unnatural World*. New York: St. Martin's Press.

Nickell, Joe. 2009. Quest for the giant eel. Skeptical Inquirer 33(4) (July/August).

Smithsonian Ocean: Giant Squid. 2018. Available online at https://ocean.si.edu/ocean-life-/invertebrates/giant-squid; accessed September 18, 2018.

Snow, Edward Rowe. 1948. *Mysteries and Adventures Along the Atlantic Coast*. Edition updated by Jeremy d'Entremont; Carlile MA: Commonwealth Editions, 2004, 133–134.

A Successor to the Sea Serpent. 1874. *The Times* (London) (July 4): 8.

Verne, Jules. 1869. *Twenty Thousand Leagues under the Sea*. English translation, Project Gutenberg ebook, updated 2016, chapter XVIII: "The Poulps" (pp. 127–147).

A Very Strange Story. 1874. *Homeward Mail from India, China and the East* (June 29).

**NOTES ON A STRANGE WORLD]** MASSIMO POLIDORO

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# How to Be Skeptics 2.0 with the Help of … YouTube

Since skepticism was born as an organized movement in 1976 with the creation of the Committee for the Scientific Investigation of Claims of the Paranormal (now CSI, the Committee for Skeptical Inquiry), a constant goal has been the attempt to reach as wide an audience as possible.

### How We Used to Reach Audiences

The skeptic's message was quite novel at the time—and it still is. We are basically saying that people should be skeptical of unsubstantiated claims, especially if they are extraordinary ones. Back then, UFOs, astrology, the paranormal, spiritualism, and many other similar topics were usually regarded quite valid among the public (and, well … they often still are today!) but had little or no substance at all once you started investigating.

So, how did you go about spreading this kind of counterintuitive information? At first there was the Skeptical Inquirer, pioneer of all skeptical magazines. But even though a magazine is essential to stay updated and go deeper on many subjects, it has a very limited reach. Most importantly, it mainly reaches those who are already convinced. So how could one reach a wider audience?

Well, if one had done enough research and work, one could try and write a book—provided that a publisher was interested. If so, very good! A book allows an author to go a lot deeper into a subject than a magazine article.

But, still, how many of those who watch talk shows on TV, where the paranormal is often the subject of very gullible treatments, actually read any skeptical books about the topics? Probably none. And how many actually read *any* book at all?

According to surveys, things do not look any brighter today. In Europe, for example, those who read books, according to a survey by Eurostat, are at most 20 percent of the population. And how much time is spent every day reading books? Between two and thirteen minutes a day, says the same survey.

**How many of those who watch talk shows on TV, where the paranormal is often the subject of very gullible treatments, actually read any skeptical books about the topics? Probably none.**

Let's just look at the time spent watching TV: according to the International Communications Market report, an annual survey by the United Kingdom's telecoms regulator Ofcom, the average American watches 282 minutes of broadcast television a day, or four hours and forty-two minutes. Things were not all that different back in the 1970s and the following decades. People were glued to the television and were not reading skeptical literature. So, how could you reach them?

Well, the obvious answer was to try and get on television. But that was not easy at all. Of course, someone like the Amazing Randi was great at getting on TV and putting on a fantastic show to watch, and by doing so became an inspiration to thousands—perhaps tens or hundreds of thousands—of skeptics worldwide. But he was the exception.

The lesser-known skeptics usually had to wait for some TV program to call him or her, as an expert, maybe, on a panel. And maybe the other panelists were a vampirologist, a medium, an astrologer, and an aura reader. They all had their say, claiming wonderful and outlandish things.

In the last five minutes of the show, however, the skeptic was asked for his or her opinion and then tried to counterattack the preceding idiocy, but he or she often only managed to appear to be a closed-minded denier, probably a paid shill in some shadowy conspiracy. And, in any case, the skeptic was constantly interrupted by the other guests, who protested against such cruel attacks, and in a blink the time was up. So much for the skeptical point of view.

### Reaching an Audience Today

Today things have changed. In less than a generation, we've reached a point where what we watch, read, and listen to is no longer determined solely by corporate monopolies but by the viewer. And things can be a lot different for skeptics as well. It is up to

us to take this opportunity while there is still time.

Today people, especially young people, read less and less. But, importantly, they also spend less time on TV. Young people should be the main target audience for skeptics, since adults already have their opinions set. Children and young adults are still forming their reasoning faculties, and if they are given the tools with which they can operate in the world and nurture a critical mind, they will become skeptical by themselves when they grow up, with no need for others to tell them.

That's why in Italy our skeptics group CICAP, after many years of attempts, has finally signed an agreement with the Ministry of Education to offer courses to teachers and students alike, sharing a scientific approach and critical thinking tools. But apart from this, which is not a very practical road for all, there are simpler ways to reach a younger audience.

So where do you find kids and young adults nowadays? Online, of course!

Yes, but where exactly? On Facebook? Oh no, Facebook is for Grandpa! They usually are on Instagram and YouTube. Actually, today 1.5 billion people turn to YouTube every month to search about something that they are interested in and can't find anywhere else. Many look for the latest funny or viral videos—even the news and TV shows are there—but many just come to learn something new or indulge an interest. And it is to these people that we should be talking right now.

Is this crazy? Making videos and uploading them on YouTube? Absolutely not. There are hundreds of thousands of creators around the world who are turning their creativity into careers, amassing huge followings and turning a hobby into a profession. There are makeup artists, video gamers, travelers who talk about their trips, vloggers, cooks who share their recipes … . Why shouldn't the skeptics join in?

In fact, some have, and you can find them on YouTube. A few have had fantastic results, such as Captain Disillusion, who has over a million subscribers, or Richard Wiseman, who has more than two million!

But apart from these extraordinary examples, skeptical videos rarely touch the topics that young people are more interested in. They may have very interesting but long discussions about the philosophy of skepticism or some very technical issue. These are both fine subjects, but they are best for an audience that is already skeptical or into these topics. Instead, we should create more videos that address the general curiosities and interests that people have—things about which we skeptics have already talked *ad nauseam* among ourselves but that to new generations appear as mysterious as ever.

There are a gazillion videos out there talking about the paranormal that portray the mysteries as though they are inexplicable, while in reality the explanations are available—in magazine articles and books. But not in YouTube videos.

### My Attempt—and Your Turn

With this situation in mind, last April I started my own YouTube series in Italian. It is called *Strane Storie* (*Strange Stories*) and runs weekly every Friday at 1:30 PM.

Each episode is ten to fifteen minutes, and in a light way I examine popular unusual claims and by the end of each show I arrive at a conclusion about their credibility. I have dealt with some classics, such as the Bermuda Triangle, the Loch Ness monster, the pyramids, the Shroud of Turin, ghosts, and aliens, but also some less popular topics, such as the Cottingley fairies, cursed paintings, the Charlie Charlie Challenge, time travelers, and more.

I started with a few hundred subscribers that I had gathered along the years of doing practically nothing on my channel except uploading the occasional video of a lecture or a TV show I was on. I never produced anything.

After I started uploading videos, I soon reached the first 1,000 subscribers. Then soon they were 2,000 then 3,000, and after six months, they were 8,000 and keep on growing. The great thing about YouTube is that it is not a social outlet, such as Facebook or Twitter, where everything that you publish gets quickly lost in the stream.

YouTube is a search engine; actually it's the second largest search engine in the world, after Google. And, guess what? Google owns YouTube. This means that whenever someone looks for a specific topic, your video may come up on both search engines. And this can happen the month after you published your video, a year … or ten years!

A magazine only lasts a week; a book may last two or three months in a bookstore and then it's gone, unless you know what to look for. A TV show lasts only a few minutes and then it's gone, along with the skeptical guest who was in it. Instead, the videos on YouTube stay there: ready to be found by anybody searching for that very specific subject. There will be three to five billion new consumers coming online between now and the year 2020. That's why right now is a great time to get started on YouTube.

And this is also the reason I decided to start producing a new series along with *Strane Storie*, but this time in English. This new series is titled *Stranger Stories*, and it started on October 31, 2018, with an episode dedicated to Randi and to the extraordinary demonstration he gave during the Allan Spraggett show, where he was able to break a spoon and guess a drawing in a sealed envelope without even having been informed in advance that he had to perform such demonstrations! It was a fantastic demonstration of critical thinking that, I think, is an ingenious and quite entertaining way to introduce viewers to the skeptical approach. I hope you will check it out and, if you like it, subscribe to my channel!

If you think this requires years of preparation or technical abilities, think twice. I am not a tech kind of guy; I've worked on TV a lot but always in front of the camera. I had to learn how to do all of what is needed: how to shoot, what kind of equipment to use, how to position the lights, how to use the green screen, how to edit, and so on.

I understand it may seem daunting, but one can just start with the camera on your smartphone. It's as simple as that! And, anyway, I can assure you that if I was able to do it anyone can. I look forward to seeing your skeptical videos on YouTube! ■

## [ REALITY IS THE BEST MEDICINE HARRIET HALL

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# Is Acupuncture Winning?

When I first heard of acupuncture in medical school in the late 1960s, I became convinced that it worked. I read impressive media reports from China touting it for everything from pain relief to anesthesia for open heart surgery. Our Chief of Anesthesiology, Dr. John Bonica, was also convinced it worked and was studying it. As time passed, more and more studies were published, and Dr. Bonica eventually gave up on it. So did I.

I monitored the evolving research with great interest. Originally acupuncture was claimed to work for a laundry list of things, but only two things passed the tests: pain and postoperative nausea and vomiting. Even for those, systematic reviews disagreed with each other, so in April 2011, Edzard Ernst et al. published a systematic review of systematic reviews of acupuncture for pain in the journal *Pain*.[1] They found a mix of positive, negative, and inconclusive results. They found only four conditions for which more than one systematic review reached the same conclusion: three times they agreed that it didn't work. The fourth time, they agreed that it *did* work—for pain in the neck. I was asked to write an accompanying opinion piece, which I titled "Acupuncture's Claims Punctured: Not Effective for Pain, Not Harmless."[2] I wrote:

> … when a treatment is truly effective, studies tend to produce more convincing results as time passes and the weight of evidence accumulates. When a treatment is extensively studied for decades and the evidence continues to be inconsistent, it becomes more and more likely that the treatment is not truly effective. This appears to be the case for acupuncture. In fact, taken as a whole, the published (and scientifically rigorous) evidence leads to the conclusion that acupuncture is no more effective than placebo.

**I pointed out that it seemed very unlikely that a treatment for pain would only relieve pain in the neck but not elsewhere in the body.**

I pointed out that it seemed very unlikely that a treatment for pain would only relieve pain in the neck but not elsewhere in the body. I pointed out the difficulty of doing good acupuncture research, since appropriate controls are hard to find, double blinding is next to impossible, and there are many kinds of "acupuncture"—including electroacupuncture, ear acupuncture, cupping, and many other variants. I pointed out that it doesn't seem to matter where you put the needles or even if you use needles at all; one study found that touching the skin with toothpicks was equally effective! All that really seems to matter is if the patient *believes* in acupuncture and believes he got the real thing.

My opinion was confirmed in 2013

when David Colquhoun and Steven Novella reviewed all the published evidence and published an article in the journal *Anesthesia and Analgesia*.[3] They found that "the benefits of acupuncture are likely nonexistent, or at best are too small and too transient to be of any clinical significance," and they concluded that acupuncture is a theatrical placebo.

Other publications and organizations, including the *Medical Letter*, the Center for Inquiry, and Sciencebasedmedicine.org have all declared that acupuncture is ineffective except as a placebo.

#### Should We Use Placebos?

It is often argued that even if acupuncture is only a placebo, it does "please" many patients (after all, the word *placebo* is Latin for "I please") so it is worthwhile using it. People say it does no harm, but Ernst et al. found ninety-five reports of serious harm to patients; some but not all of these could have been prevented by better sterile precautions and better education in anatomy. There are other harms, including the waste of time and money, and patients may be tempted to use acupuncture instead of treatments that are truly effective.

And of course, we wouldn't give patients a sugar pill placebo. Where do we draw the line? Medical ethicists universally condemn prescription of placebos because it constitutes lying to patients. Studies have been done where patients were aware that they were getting a placebo, but the researchers presented placebos in a way that led patients to believe placebos were effective. Just receiving a pill from a doctor is an indication to patients that it is supposed to work, creating the kind of suggestion that is likely to produce a placebo effect.

**One study found that touching the skin with toothpicks was equally effective as acupuncture!**

#### The Missing Mechanism

Acupuncture is "ancient wisdom" based on prescientific fumbling. The concepts of meridians and acupoints are mythical. They have never been detected by anatomists. The concept of a vital force, "human energy field," qi, or chi is also mythical. Physicists have measured all kinds of energies down to the subatomic level but have never detected qi. Acupuncturists believe these myths and are so convinced that acupuncture works that they have tried to come up with a scientific rationale for how it might work.

**My opinion was confirmed in 2013 when David Colquhoun and Steven Novella reviewed all the published evidence and concluded that acupuncture is a theatrical placebo.**

Remember Ray Hyman's Categorical Imperative: "Do not try to explain something until you are sure there is something to be explained." Acupuncturists were sure acupuncture worked, so they proceeded to propose all kinds of hypothetical explanations of how it might work.

It was shown to release natural pain-relieving endorphins in the brain, but so do placebos! Endorphins are released in the brains of animals when a stick is thrown for a dog or when a horse is trailered. The gate theory of pain offers a physiological explanation for the previously observed effect of psychology on pain perception. Was it just counterirritant effects, like hitting your thumb with a hammer to make you forget your headache? In a 2000 article in a Japanese journal, acupuncture, moxibustion, and a hemostat on the tail were compared as pain blocks in mice. The hemostat on the tail won! Researchers have looked at neurovascular bundles, trigger points, connective tissue fascial planes, areas of reduced electrical impedance, and enhanced migration of nuclear tracers. The studies are flawed and inconclusive, and they contradict each other. No consensus has been reached.

We already have a perfectly good explanation of how acupuncture "works." It is a theatrical placebo that is very good at eliciting placebo responses. Patients are impressed by the surrounding ritual and the "ancient wisdom" mumbo jumbo. They get personal attention from a charismatic provider. Appointments are long, and patients relax. They respond to TLC and hands-on treatment. Providers make strong suggestions that acupuncture will relieve symptoms, creating expectations in the patients. There are no specific effects, but there are many nonspecific effects of the provider/patient interaction. A famous study of asthma patients showed that patients subjectively felt better with an Albuterol inhaler, a placebo inhaler, or sham acupuncture but were only objectively better on lung function tests if they had used the Albuterol inhaler.

### Many People Believe

So acupuncture doesn't work except as a placebo, but it is widely *perceived* to work. By 2002, 8.2 million American adults had tried it. It has been infiltrating our hospitals and medical schools and even affecting our laws. As Jann Bellamy wrote on the *Science-Based Medicine* blog, "we are all too familiar with opinion and whim beating out science in legislation and regulations." There are state laws promoting auricular acupuncture for substance abuse treatment. Medicaid has reimbursed doctors and hospitals for acupuncture treatment of drug addicts. Many medical insurance programs cover acupuncture. The World Health Organization (WHO) recognizes acupuncture as an effective form of treatment. The National Center for Complementary and Integrative Health (NCCIH) says it is effective for back pain and a few other conditions. The Mayo Clinic recommends it and says, "Increasingly, it is being used for overall wellness, including stress management." The *Harvard Health Blog* says it's worth a try for chronic pain. The Cleveland Clinic says it is effective for various conditions. The American Academy of Family Physicians (AAFP) recommends it as first-line noninvasive treatment for back pain and says electroacupuncture should be considered for patients with fibromyalgia. And many other professional organizations support using it.

What this boils down to is the difference between evidence-based medicine (EBM) as it is commonly practiced and science-based medicine (SBM) as it should be practiced. This was the reason we started the SBM blog, sciencebasedmedicine.org. For EBM, it is enough to have positive trials. They accept positive results of therapeutic trials based on fantasy, such as Reiki, homeopathy, and therapeutic touch. Trying to apply the tools of science to these therapeutic modalities based on fantasy just produces a lot of confusing noise. For SBM, we also look at other factors such as prior plausibility and compatibility with established science.

**Acupuncture is "ancient wisdom" based on prescientific fumbling. The concepts of meridians and acupoints are mythical. They have never been detected by anatomists.**

There are many true believers in acupuncture. Personal experience is compelling. Patients who got better believe it works, but they may have succumbed to the *post hoc ergo propter hoc* fallacy ("after this, therefore because of this"). The rooster crowed, then the sun came up; therefore, the rooster made the sun come up. I got better after a treatment; therefore, the treatment made me better. That may be true, but sometimes it's just as wrong as the rooster. The patient might have improved with no treatment, just from the natural course of the disease, or from some other factor that they don't give credit to. Without a comparison control group, there's no way to know.

### There Is Hope

Acupuncture seems to be winning. Less-than-rigorous science is being accepted. Good evidence is being disregarded. A lot of patients and doctors are convinced it works. This has been called the Age of Endarkenment and the Post-Truth Era. But there is hope.

Recently I gave a lecture at Ohlone College on "Evaluating Evidence in Medicine: What Can Go Wrong." Among other things, I mentioned that acupuncture was a theatrical placebo. During the Q&A, I was challenged by a woman who insisted acupuncture had worked to cure her migraines and other symptoms. She was persistent and argumentative, determined to get me to agree that acupuncture *did* work. I finally told her it had been tested in large groups of people with controlled studies and shown not to work; if it didn't work in those large controlled trials, why would it work for her? Maybe she was special? That got a laugh, even from her, but she kept trying to convince me that acupuncture really did work.

The professor who invited me reported, "I've taught all five of my classes over the past two days, and in each, people had wonderful things to say about your presentation. Of course, many of them revolved around that 'interesting' woman who stood up during the Q&A to debate you about acupuncture, but again, my students took your side (i.e., the side of the evidence!), and simply expressed wonder at her persistence."

That was very encouraging. It showed that the students understood my message and were able to apply it. Acupuncture may be winning, but if we can educate the public about science and critical thinking, we might be able to reverse the trend. The Skeptical Inquirer is one effort in the right direction. ■

### Notes

1. https://journals.lww.com/pain/Abstract/2011/04000/Acupuncture__Does_it_alleviate_pain_and_are_there.11.aspx
2. https://www.ncbi.nlm.nih.gov/pubmed/21440190
3. http://www.dcscience.net/Colquhoun-Novella-A&A-2013.pdf

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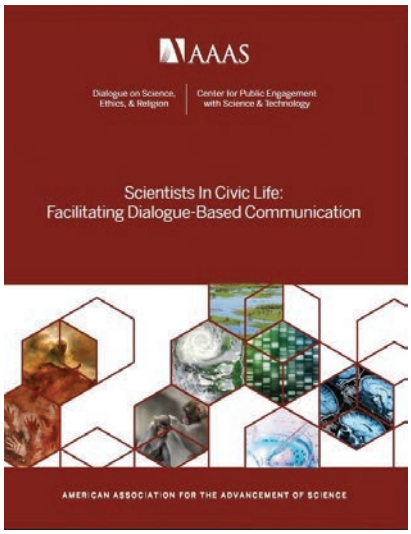
# Talking Science and Society at Church

## Let's Put Aside Differences to Tackle Society's Biggest Challenges

Over the past two decades, high profile debates over human origins, abortion, and stem cell research have distracted from the opportunities that scientists, skeptics, and religious Americans have to forge relationships built on common values and goals.

Though topics such as the teaching of evolution may generate disagreements, other areas of science (such as health, sustainability, climate change, and food security) may not. Even in the face of disagreements, dialogue-based efforts can help break down stereotypes between scientists, skeptics, and people of faith, cultivating mutual respect and personal relationships, leading to collaboration on society's most pressing problems.

These are some of the main points emphasized in a recent report *Scientists in Civic Life: Facilitating Dialogue-Based Communication*, which I authored on behalf of the American Association for the Advancement of Science (AAAS) (Nisbet 2018). The booklet provides an overview on relevant research, practices, and examples that scientists, skeptics, and their partners can draw on to encourage more thoughtful dialogue about science and society.


AAAS
Dialogue on Science, Ethics, & Religion
Center for Public Engagement with Science & Technology
Scientists In Civic Life:
Facilitating Dialogue-Based Communication
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

**Though topics such as the teaching of evolution may generate disagreements among scientists, skeptics, and religious Americans, other areas of science (such as health, sustainability, climate change, and food security) may not.**

As one of the world's largest scientific societies, AAAS has long emphasized the importance of public dialogue to its membership and the scientific community at large. "[Scientists] need to engage the public in a more open and honest, bidirectional dialogue about science and technology … addressing not only the inherent benefits, but also the limits, perils, and pitfalls," wrote former CEO Alan Leshner in a 2003 *Science* editorial. Consistent with this mission, the aim of the new booklet is to empower scientists and their institutions to play a more active role in bringing Americans of diverse backgrounds together to spend time talking to each other, contributing to mutual appreciation and collaboration.

Churches are a vital place to begin.

### Networks of Engagement

When I moved in 2014 with my family from Washington, D.C., to a small city north of Boston, I was surprised to find that my new community had a locally based group of volunteers who were working to promote climate change resilience efforts along the city's riverfront and ocean coastline. The hub for this group was a centuries-old church

at the center of town, where members would meet during evenings and after Sunday services to plan their efforts and recruit new volunteers.

Religion, as this example shows, is more than just a belief system that shapes how people understand or prioritize a problem such as climate change. Churches are communication centers where information is shared and conversations can take place about complex science-related issues.

For these reasons and others, it is important for scientists and other experts to build deep relationships with their local churches, temples, and mosques. Congregational leaders rely on strong interpersonal bonds and norms of stewardship to encourage their members to participate in civic-related activities. These networks are further strengthened by the moral framing of issues by church leaders, the conversations that churchgoers have with others, and information provided directly when at church (Lewis et al. 2013).

**The aim is to empower scientists and their institutions to play a more active role in bringing Americans of diverse backgrounds together to spend time talking to each other, contributing to mutual appreciation and collaboration.**

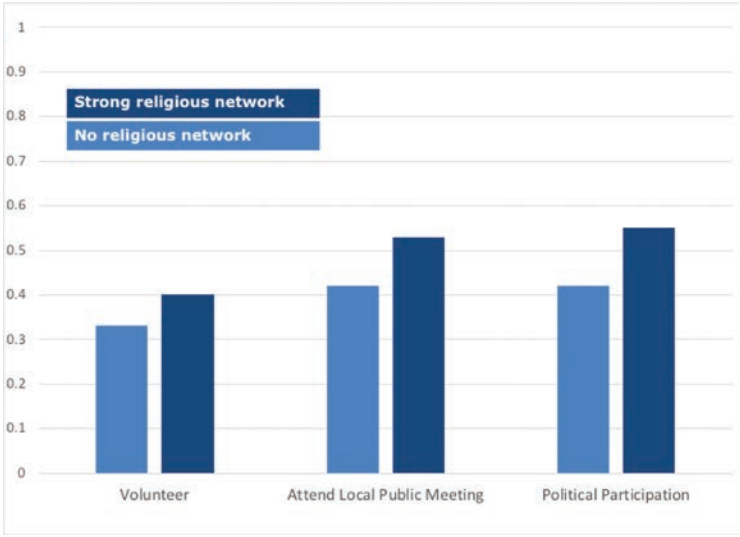
Even today, research shows that churches remain the social context where Americans are most likely to receive requests to become involved in their communities (see Figure 1). Specific to science-related issues, they may be called upon to help people recover from the impacts of climate change, to work on actions to educate their communities about public health, or to voice their opinions to elected officials on topics such as evolution or biomedical research.

**Table 1. Religious Beliefs and Behaviors Among U.S./U.K. Biologists and Physicists**

| | U.S. % | U.K % |
|---|---|---|
| Identifies with some religious affiliation | 39 | 37 |
| Claims to be at least a slightly religious person | 30 | 27 |
| I know God exists, no doubts | 10 | 9 |
| Reports praying once a day or more | 11 | 9 |
| Reports attending religious services weekly | 11 | 8 |
| Number of respondents | 1,779 | 1,531 |
| Response rate by percent | 57 | 50 |

Note: Survey conducted during 2011–12. Respondents include biologists and physicists affiliated with universities and research institutes. Source: Ecklund et al. (2016).

**Figure 1. Churches as Engines of Civic Engagement**




Note: Predicted probabilities of engaging in each activity by religious network strength, holding religious attendance and all control variables at their means.

Source: Lewis et al. 2013

### Dialogue in a Turbulent World

In facilitating productive dialogue about science topics that intersect with faith and religion, all scientists and academics have a role to play. Regardless of their personal beliefs, when engaging in conversations with faith communities, scientists can connect around common values and interests.

Every scientist is also likely to find something in common with people and groups who live and work in their local community. As fellow residents, scientists can build connections by way of their identification with local pastimes, sport teams, entertainment choices, favorite businesses, economic trends, school districts, cultural traditions, natural resources, and climate/weather events.

Consider E.O. Wilson's (2006) approach to facilitating a dialogue with religious leaders and their communities. In his book *The Creation*, Wilson described environmental stewardship as not only a scientific matter but also one of personal and moral duty. Wilson's aim in writing the book was to engage a religious audience that might not otherwise pay attention to popular science books or, for that matter, appeals on the environment. Wilson passionately believed, as he told Bill Moyers in a 2007 interview:

> [If atheists and religious folk] sat down and talked about our deepest beliefs together, we'd come up with

> more agreements, than disagreements. …Science and religion are the two most powerful social forces in the world. Having them at odds at each other all the way up to the highest levels of government and the popular media all the time is not productive.

### Boundary Spanners

Scientists who are themselves already a part of faith communities may be particularly well-positioned to serve as trusted dialogue brokers. By one 2011–2012 survey estimate, approximately 11 percent of U.S. biologists and physicists say they attend church services at least weekly, and a similar proportion say they hold no doubts about the existence of God. More than one third claim a religious affiliation (Ecklund 2016) (see Table 1).

Through their shared beliefs and community membership, these boundary spanners are likely to be effective at facilitating conversations between their fellow scientists and those members of the public who share their faith. In doing so, they can draw on their own experience to share insights on the relationship between science and their personal faith. A leading example is Texas Tech climate scientist Katharine Hayhoe, who as a Christian evangelical regularly speaks to congregations about climate science, drawing on her faith to connect to audiences by way of a shared identity and language.

### Science in Seminaries

Many religious leaders and clergy are also interested in facilitating constructive conversations among their congregations and faith communities about scientific topics. Unfortunately, clergy have historically not been likely to have formal training in how to lead thoughtful dialogue about the social implications of science. To address this gap, the AAAS DoSER program has partnered with Christian seminaries and theological schools to include more science in their core curricula as part of an ongoing "Science for Seminaries" project.

Each partner seminary, in consultation with AAAS, integrates science articles, books, films, guest lectures, laboratory and research site visits, and other content into core course offerings such as biblical studies, church history, and theology. These resources are developed in collaboration with local scientists to build and strengthen relationships with local science institutions. A program called Scientists in Synagogues is a similar grassroots initiative designed to equip Jewish clergy, scientists, and laypeople with the knowledge and skills to engage in dialogue and learn about society's biggest questions, drawing on science and religion as sources of wisdom and inspiration.

At synagogues and Jewish community centers, the program sponsors adult education courses, lectures, and events on topics exploring the intersections among Judaism, neuroscience, astronomy, evolutionary science, moral psychology, and other scientific fields.

**Research shows that churches remain the social context where Americans are most likely to receive requests to become involved in their communities.**

### Talking Faith and Climate

Specific to climate change, research conducted by the U.K.-based nonprofit ClimateOutreach has examined the narratives, metaphors, imagery, and frames of reference that can be used by scientists and religious leaders to engage people of faith by way of informal conversations, public statements, popular articles, and sermons. This research and similar studies recommend presenting a commitment to climate change as representing a moral responsibility to God, our children, neighbors, the "least of us," and "all of creation." Climate change can be discussed as part of a story arc that encompasses a challenge, an action, and a resolution—a narrative style familiar from scripture (Roberts and Clarke 2016).

Yet even when framed in such terms by the highest religious authorities, scientists and science communicators should recognize that this approach has limits, especially outside of a localized, dialogue-focused framework. For example, an analysis of responses by Catholics to Pope Francis's 2015 *Laudato si* encyclical on climate change found, somewhat predictably, that liberal Catholics tended to assign the pontiff greater credibility on the issue, while more conservative Catholics assigned the pontiff less credibility. In this case, the political identity of these Catholics tended to trump their faith-based one (Li et al. 2016).

Looking ahead, as more and more scientists and their institutions turn to locally focused dialogue activities to engage publics on the biggest science and society questions, a first step toward improved relations with religious Americans and their churches may be simply to recognize and affirm shared values, beliefs, and goals. With this established, further dialogue can be structured in such a way as to encourage working together toward common goals on climate change and other pressing problems. ■

### References


Ecklund, Elaine Howard, David R. Johnson, Christopher P. Scheitle, et al. 2016. Religion among scientists in international context: A new study of scientists in eight regions. *Socius* 2: 2378023116664353.

Leshner, A.I. 2003. Public engagement with science. *Science* 299(5609): 977.

Lewis, Valerie A., Carol Ann MacGregor, and Robert D. Putnam. 2013. Religion, networks, and neighborliness: The impact of religious social networks on civic engagement. *Social Science Research* 42(2): 331–346.

Li, N., J. Hilgard, D.A. Scheufele, et al. 2016. Cross-pressuring conservative Catholics? Effects of Pope Francis' encyclical on the US public opinion on climate change. *Climatic Change* 139(3–4): 367–380.

Nisbet, M.C. 2018. *Scientists in Civic Life: Facilitating Dialogue-Based Communication*. Washington, DC: American Association for the Advancement of Science. Available online at https://www.aaas.org/programs/dialogue-science-ethics-and-religion/resources-engaging-scientists-project.

Roberts, O., and J. Clarke. 2016. Faith & Climate Change - A guide to talking with the five major faiths. Oxford: Climate Outreach. Available online at http://climateoutreach.org/resources/climate-change-faith.

Wilson, E.O. 2006. *The Creation: An Appeal to Save Life on Earth*. New York: WW Norton & Company.

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# 'Class A' Bigfoot Report Reveals Little about the Beast—and Much about the Seekers

**Q: I heard about a Bigfoot sighting not far from here. It happened a few years ago. There was a team of firefighters working on the Tres Lagunas fire in northern New Mexico. They saw a Bigfoot not far away, out in the open during the daytime, and it couldn't have been a deer or bear. What do you think about that case?**

**—Michelle M.**

**A:** I was asked the above question at a local writer's group meeting by a fellow writer who heard some of my book subjects (including lake monsters and the chupacabra). I replied that I hadn't heard of that specific sighting, but that I'd look into it. She seemed slightly surprised that I—as a New Mexico–based Bigfoot researcher of some minor renown—wasn't familiar with such a significant, credible sighting in our home state.

Much of the Land of Enchantment is of course desert—and thus not an ideal habitat for a group of large creatures that presumably hide from scrutiny under the verdant canopy of the densely forested Pacific Northwest and other sylvan regions—but there are several forests and remote areas with water and food that could theoretically support large unknown animals. Occasional reports, none of them particularly credible, have emerged about Bigfoot sightings in the foothills of the Sandia Mountains in Albuquerque (not far from where SI Editor Ken Frazier lives) and farther north. The Tres Lagunas fire she referred to was started by a tree falling on a power line on May 30, 2013, that burned 10,200 acres of land in the Pecos Canyon area of northern New Mexico over the course of three weeks.

**I began researching the topic and soon realized why I hadn't heard of the incident: It never happened, or at least not as described.**

I began researching the topic and soon realized why I hadn't heard of the incident: It never happened, or at least not as described. As is often the case with these types of stories, the person who heard it got key details wrong. The alleged incident happened at the *Del Loma* fire in northern *California* in *2003* (which began on September 15 and burned approximately 3,000

acres)—not the *Tres Lagunas* fire in northern *New Mexico* in *2013*. Other than different fires being separated by a decade and two states, the outline of the story was correct (as we will see, there was indeed a New Mexico connection).

**The additional information raises more questions than it answers, including about the animal's remarkable proximity.**

Descriptions of the incident appear in several places online, including the forums of *The Sasquatch Chronicles* podcast, taken from the Bigfoot Field Researchers Organization (BRFO) website:

> **Firefighter describes multiple-witness sighting during the Loma Fire:**
>
> "I was working in the northern part of New Mexico training to be a Wildland Fire Fighter. In September 2003 (maybe the second week of that month) I was dispatched with 22 other people to the Del Loma Fire in the Shasta/Trinity Forest area, the Northern part of California. Each Crew had about 20 people, our plane that left Albuquerque held 2 crews. For almost the whole two weeks, we were all on standby. On the 4th to the last day of our 2 weeks of Fire call, we were setting up camp close to a river, about 5-10 miles out from the original forest fire. It was close to sun down when, a couple of guys were amazed at something. I heard them from inside my tent, but just ignored the whole thing until one of my crew members came and pulled me out of my tent.
>
> I had no idea what I was supposed to be looking at or for. He pointed across the river and I was in shock when he pointed out the biggest, hairiest mammal I had ever seen just walking along the river side minding his own business. It stopped and looked at us. The way he stood on his hind legs was like an ordinary human. He had dark, long hair and stood about 7ft tall with a muscular build.
>
> At this point I was the 4th person standing there in amazement. Maybe about 5 minutes of watching him watch us, with more people coming out with flashlights (because the sun was still going down) he darted in to the trees. He was running, taking long strides, and was gone in about 3 seconds … and was literally pushing trees out of his way (not breaking them, but pushing them out of his way). The trees behind him on his path up the mountain were swaying back and forth. I was surprised to see to these trees moving because they are thick in width and very tall. By this time it was dark but lit enough to see which way he was headed. Up the mountain a little, there was a clearing, where we spotted him again before he disappeared for good. He made no noise, no yelling or screaming. He was just as timid as can be. I have heard many stories about Bigfoot, and known that they are real but when seeing one in real life … you get a sense of respect for them and just have that feeling that there is more to life than you know." (https://tinyurl.com/y88lh3tl)

A user on the Sasquatch Chronicles forum with the handle "Papa–Yeti" responded to the account on May 3, 2015, with the following comment:

> What I really find great about this encounter, is that it really shuts–up the pie holes of hard Skeptics! Why? Because Smoke Jumpers, and Fire crews are all business no bull shit people putting their own lives on the line, some perish in those forest fires, some die when their transport air craft crash into mountains because of flight errors, and mechanical failures. And so this man's statement that he and others of the 22 men crew of the Fire fighters saw a SASQUATCH!! If it looks like a Sasquatch and moves like a Sasquatch then is not a hoax or a damn duck! So in this encounter case. Perfect encounter case and may there be many more just like this one.[1]

This report—touted by Bigfoot believers as a "great" and "perfect" encounter so credible that it's sure to silence skeptics—was apparently interesting enough to merit a follow up by BFRO investigator Brandon Kiel, who added a few more details to his write up of the "Class A" sighting in report # 13419.[2]

Kiel states that the report was "submitted by witness on Saturday, December 31, 2005," and that:

> I spoke to the witness for nearly 45 minutes. She is very sincere and credible. Additional information gathered during the conversation: The time of day was dusk but still light enough to see color and detail. She says the animal was walking down the river bank approximately 25 yards from the campsite. It did not seem to notice the slowly gathering crowd until a few of them began to shine flashlights in its direction. It was brown in color and the hair was 5"-6" in length. She could not make out the sex of the animal. The eyes had a reflective shine to them but she could not make out whites of the eyes or a color. No one yelled at the animal or attempted to disturb it. At first it seemed intrigued by them but after about 2–3 minutes it became spooked and turned to run into the woods that lined the river banks. She said it showed great strength in that it easily pushed aside good sized trees to make its escape and that they could plot its path through the woods by watching the movements of the trees. The silhouette of the animal was seen again as it came into a clearing, and then went out of view. There were no vocalizations during the observation. The witness is female and from the Apache Indian Reservation (Jicarilla) in northern New Mexico. She is a now 21 year-old, reserve woodland firefighter.

The additional information (which would have been more useful as a verbatim quote, not a second-hand paraphrasing of what she said, as important details can easily be lost when summarizing) raises more questions than it answers, including about the animal's remarkable proximity. Given how famously reclusive Bigfoot are—hence the proliferation of blurry photos and videos taken from a great distance—this particular creature seems to have been uncharacteristically cavalier about wandering near groups of people. At only twenty-five yards (seventy-five feet, or the length of a typical American swimming pool), the Bigfoot came very

close to the group for several minutes. It's also curious that the witness waited nearly two years to make a report.

#### Other Witnesses

It's not clear how many of the crew saw the creature, but given its extended duration and the description of "more people" coming with flashlights, it seems likely that there were at least a dozen witnesses, possibly nearly twice that many. What of those other witnesses? Kiel concluded, "If you were one of the other eyewitnesses to this incident during the Del Loma Fire of September, 2003, please contact us via the Comments form." As of mid-2018, fifteen years after the alleged sighting, there is no additional information about the event, suggesting that none of the other firefighters have come forward to corroborate her story. Kiel did not respond to queries asking if the BFRO had received any further information on the sighting.

Many Bigfoot eyewitnesses describe their encounters as life changing, and to see one up close for such an extended period of time must surely have been a profound experience even for the most hardened of firefighters. Yet no one else present that day has come forward to share their experience—even anonymously should they fear the conspiracy-esque "wall of skeptical ridicule" that some suggest "silences" witnesses (Joshua Blu Buhs, in his book *Bigfoot: The Life and Times of a Legend*, claims that ridicule is "the skeptics' primary weapon" [p. 219]). The event was apparently so unremarkable that none of the firefighters searched the next morning for (or photographed) any mysterious footprints left on the riverbank or the trademark trail of trees pushed over with astounding ease.

#### Pseudoscience and Pseudo-Investigation

Perhaps even more surprising than the account itself is that the Bigfoot Field Research Organization, which touts itself as the world's "only scientific research organization exploring the bigfoot/sasquatch mystery," hasn't investigated this potentially important "Class A" report. If this story is true as told, it could potentially be one of the most significant Bigfoot reports in modern American history. Given the duration, nearness, and multiple witnesses, others there that day might have gotten close-up photos or even video of the mysterious creature (the first cell phone cameras were introduced the year before). Yet Kiel and the BFRO seem curiously uninterested in pursuing the story.

**The event was apparently so unremarkable that none of the firefighters searched the next morning for (or photographed) any mysterious footprints left on the riverbank.**

Instead of posting a short addendum to the report seeking additional witnesses, Kiel should simply ask his anonymous informant who else was on her fire crew. Surely she knows the names of most of the people she battled blazes with for weeks. Why doesn't the BRFO already have the names? Did Kiel not ask her? Or did she develop amnesia or refuse to reveal who else shared her astonishing experience? Presumably she would be eager to have others validate her story. Even if, like her, they wished to remain anonymous to the public, their information could corroborate—or, of course, debunk—her account.

Even without her cooperation, it wouldn't be difficult to identify the firefighting crews dispatched to the Del Loma fire who camped near a river five to ten miles from where the fire started in the second week of September 2003. Firefighters, both paid and voluntary, are typically public servants; their names, positions, and assignments are not a secret. I could do it, but the burden of proof is of course on the claimant—in this case the anonymous firefighter and by extension the BFRO. I have neither the time nor interest to spend unpaid days or weeks investigating the sensational claims they promote. That's *their* job, and if they can't be bothered to make any effort to corroborate their single eyewitness to such a "credible" account, what does that say about their lesser accounts? How much time and effort does the BFRO spend on authenticating their Class B and Class C reports?

This sighting follows a familiar pattern for skeptical investigators: An initially "unexplainable" event witnessed by multiple eyewitnesses of unimpeachable credibility turns out upon closer inspection to hinge on a single anonymous person who offers no corroborating evidence at all. This case neatly illustrates the differences in approach (and what constitutes evidence) between Bigfoot believers and cryptozoology skeptics. To the BFRO, interviewing an eyewitness is the final step of an investigation; to a skeptic, it's only the beginning.

Whether out of incompetence, indolence, ignorance of proper investigation procedures, or a tacit reluctance to dig too deeply into an inherently dubious claim, researchers of the "unexplained" (and ghost and Bigfoot researchers in particular) often offer merely the pretense of investigation. They adopt the approach of pioneering paranormal promoter Charles Fort (1874–1932), an avid aggregator of "anomalous" reports who did little or no real investigation to determine which were valid and which were not. My chief complaint about the paranormal community is not that they take these topics seriously; it's that they don't take them seriously enough. ■

#### Notes

1. In contrast to Papa-Yeti's sexist assumptions, the firefighter witness, according to researcher Brandon Kiel, is a woman.

2. According to the BFRO's Report Classification System, "All reports posted into the BFRO's online database are assigned a classification: Class A, Class B, or Class C. The difference between the classifications relates to the potential for misinterpretation of what was observed or heard ... . Class A reports involve clear sightings in circumstances where misinterpretation or misidentification of other animals can be ruled out with greater confidence."

# COLD FUSION
## Thirty Years Later

In March 1989, the claim of a revolutionary discovery in nuclear energy production galvanized the scientific community. It turned into a classic case of pathological science—and a textbook example of the self-correcting nature of science.

DAVID W. BALL

The quest for controllable nuclear fusion as a societal energy source has been multigenerational, expensive, and slow. The benefits of fusion—including a near-inexhaustible fuel source, relatively mundane and non-polluting products, and significant amounts of energy produced—are balanced by the technical difficulties and equipment involved. Research into this area is so expensive that support from nation-state entities is typically necessary. It goes without saying, then, that any breakthrough in fusion research, especially one that radically simplifies it and lowers its cost, would be a major breakthrough indeed.

Such was the setting thirty years ago when a major breakthrough was announced. What followed is now considered a classic case of how science works—and how science isn't supposed to work. Here is what happened, what resulted, and how the entire series of events is viewed today.

### Announcement: 'Cold' Fusion

On March 23, 1989, officials at the University of Utah announced that two electrochemists, Stanley Pons and Martin Fleischmann, "established a sustained nuclear reaction" (Taubes 1993, xix). Leaks to the media the day before guaranteed a large crowd at this press conference, and by the next day, it was front-page news all over the world.

The press conference was prompted by two issues. First, of course, was the news itself: apparently fusion had been achieved, it had occurred in a relatively simple and inexpensive apparatus, and one of the Holy Grails of science (if anything can be considered a "holy grail" in science, surely it is sustainable nuclear fusion) was achieved by a pair of electrochemists, not nuclear physicists. But second, there were also whiffs of competition. A researcher at Brigham Young University, Steven Jones, was not only working on fusion via another process but was apparently beginning to dabble in electrochemistry with his own research group. The two research teams were aware of each other, and each one wanted to be the first to announce success. Glory, money, and prizes were at stake; scientists are first, foremost, and (perhaps unfortunately) human.

During the press conference, university officials, along with Pons and Fleischmann, described in general detail how the experiments worked: Palladium and platinum electrodes (ultimately revealed as pencil-like rods) were immersed in a solution of heavy water[1] ($D_2O$, D = deuterium = $^2H$) and an electrolyte (also ultimately revealed to be lithium deuteroxide; see below regarding concerns about the minimal release of pertinent details). Current was passed through the electrodes, and the palladium electrode apparently absorbed the deuterium atoms and somehow induced them to fuse.[2] The press conference and the accompanying press release (University of Utah 1989) claimed the detection of excess heat, gamma rays, and free neutrons that the electrochemists claimed were consistent with a nuclear reaction occurring inside the palladium electrode.

Because news of the press conference's content had

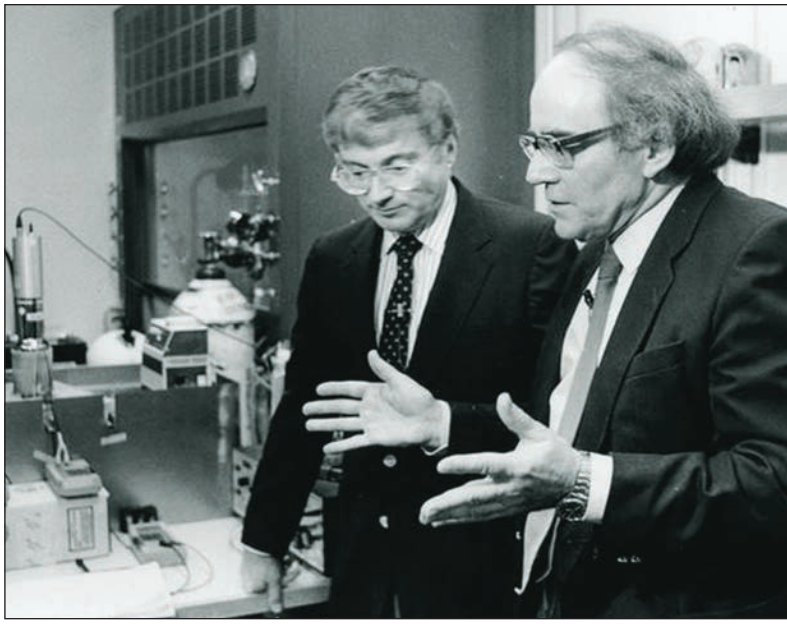
leaked the night before, the place where the meeting was held—the lobby of the Henry B. Eyring Chemistry Building on the university's campus (Taubes 1993, xvii)—was packed, and the next morning (a Friday) the news of sustained, so-called "cold," fusion was front-page news. By the end of that weekend, the governor of Utah pledged $5 million for further work in an attempt to break the "Utah effect," a name given by the university's then-president Chase Peterson for the perceived negative attitude of others in the country toward all things Utah. Peterson envisioned that Utah would become the country's, if not the world's, leader in cold fusion technology, transforming the state into the Great Basin's version of Silicon Valley. The university had already taken steps to patent this new technology. There was a lot at stake.

The day before, Pons and Fleischmann had faxed a revised manuscript to the editor of the *Journal of Electroanalytical Chemistry* (JEAC) (Fleischmann and Pons 1989; Taubes 1993, 440). Copies of the manuscript were also faxed to several colleagues, who in turn faxed it to other colleagues, and distribution of the unpublished manuscript spread rapidly.[3] Electronic mail was also nascent at this time, and news also spread via this electronic communications medium.

What's interesting is that this technique had been explored before, apparently unbeknownst to the Utah researchers. In the 1920s, German chemists Fritz Paneth and Kurt Peters at the University of Berlin attempted to produce helium by fusing hydrogen, then deuterium, using hot palladium. Their incentive was to produce helium, not energy, because of the lack of sources of domestic helium for airships; they were unsuccessful. In 1927, Swedish scientist John Tandberg tried to patent an electrochemical method of producing deuterium using palladium, but it was denied, and his experiments are also deemed to have been failures (Collins and Pinch 1994; Taubes 1993, 214; Huizenga 1993, 13).

## The Evidence

What was the evidence produced by Pons and Fleischmann that fusion was occurring? It was largely based on electrochemistry, which was no surprise; both of them were well-known electrochemists. Fleischmann had recently retired from the Faraday Chair of Chemistry at the University of Southampton after a distinguished career, which included development of the ultramicroelectrode (UME) for studying electrochemistry in very tiny volumes, including individual living cells. He also had a role in the discovery of surface-enhanced Raman scattering (SERS), a technique that increased the sensitivity of a useful method of spectroscopy by a billion-fold, significantly increasing its utility. Although Pons did not have similar landmark events in his career, he was known for his ability to construct instrumenta-



Stanley Pons (left), then chairman of the University of Utah's chemistry department, and Dr. Martin Fleischmann, then an electrochemist at England's Southampton University. 1989 photo. Credit: Paul Barker, *Deseret News*

**The two research teams were aware of each other, and each one wanted to be the first to announce success. Glory, money, and prizes were at stake; scientists are first, foremost, and (perhaps unfortunately) human.**

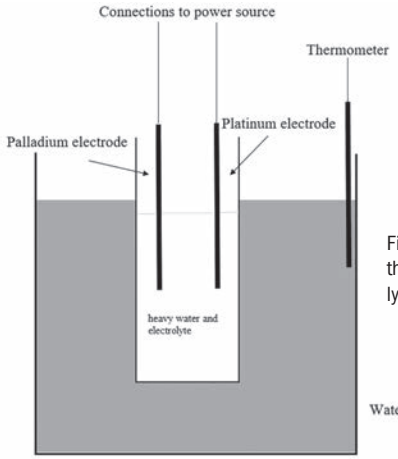



Figure 1. Rough diagram of the Pons-Fleischmann electrolytic cell.

tion, going so far as to have his own company providing electrochemical equipment. He was also a very prolific researcher, producing dozens of published papers per year at his peak.

The evidence they claimed was:

1. Excess heat/power. In the course of an experiment in which heavy water was being electrolyzed (ultimately, converting $D_2O$ into deuterium and oxygen gases) by palladium and platinum electrodes, the apparatus exploded while operating overnight, when no one was present. The apparatus was at least partially destroyed, and the palladium electrode was partially vaporized. The concrete floor underneath the apparatus was damaged, although reports differed on the details of the damage. This event occurred in the autumn of 1984 or winter of 1985.

**There's little hint of how long this press conference lasted, in part because it was apparently followed by a tour of some of the lab facilities. But there is no doubt what impact this announcement had on the scientific, political, and even military worlds.**

To Pons and Fleischmann, the only thing that could have generated enough energy for this to occur had to be nuclear in nature. Indeed, Fleischman had been speculating on this idea as far back as the 1960s, according to the University of Utah press release (University of Utah 1989). Hydrogen and its isotopes were known to be absorbed into metallic palladium at different rates, so Fleischmann apparently wondered if there were different nuclear effects involved.

The explosion set off a flurry of new studies focusing around the calorimetry of similar electrochemical cells. Calorimetry is the study of the energy changes of processes, and Pons and Fleischmann and their associates (some students, some University of Utah staff) set up a variety of calorimeters to measure the energy changes occurring in these deuterium-palladium cells (see Figure 1).

Pons and Fleischmann reported that, at least in some cases, they had seen temperature spikes in some cells that could not be balanced by the amount of electric energy going in (which was constantly measured, they claimed). It would take days or even weeks to see these spikes, during which time they presumed that the palladium electrode was absorbing deuterium atoms. At some critical juncture, the metal electrode was so loaded with deuterium that the atoms fused—that was the only thing, they argued, that could explain the production of so much excess energy in a short amount of time.

2. The release distributed at the press conference implied that the experiment also generated excess neutrons (and tritium; see below), a well-known product of deuterium fusion. The relevant reaction is (Kikuchi et al. 2012, 22): deuterium nucleus + deuterium nucleus → helium-3 nucleus + neutron (2.45 MeV).[4]

The electrochemists did not detect the neutrons directly; rather, the neutrons supposedly emitted by the fusion reaction interacted with hydrogen atoms in the water bath surrounding it. Hydrogen atoms are a reasonable absorber (the technical term is *moderator*) of neutrons and can react according the reaction: hydrogen atom + neutron → deuterium atom + γ photon (2.22 MeV). Here, "γ photon" is a gamma-ray photon having an energy of 2.22 MeV. Gamma rays are more straightforward to detect than neutrons, and having a gamma-ray signal at an energy of 2.22 MeV is characteristic of that reaction; therefore, it is good evidence for the production of neutrons.

When the Pons and Fleischmann paper was distrib-

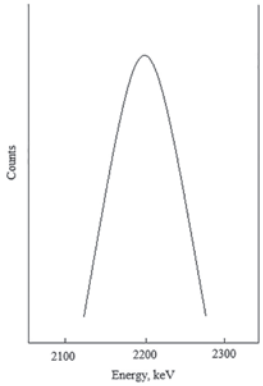



Figure 2. A representation of the neutron-induced gamma ray spectrum published by Pons and Fleischmann. Adapted from Pons and Fleischmann 1989.

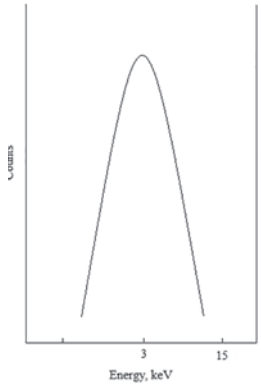



Figure 3. A representation of the beta particle energy spectrum published by Pons and Fleischmann claiming the presence of radioactive tritium. The first tick on the x-axis was unlabeled. Adapted from Pons and Fleischmann 1989.

uted, either by fax or when published, the gamma ray/neutron production evidence they gave was much like what is shown in Figure 2. While they present this evidence (called a "spectrum") as support, later investigation found serious problems with the veracity of this evidence.

3. The release distributed at the press conference implied that the experiment also generated tritium. Tritium is also generated by deuterium-deuterium fusion, according to the reaction deuterium + deuterium → tritium + proton + energy. This reaction occurs about 50 percent of the time, while the reaction producing helium, above, occurs about 50 percent of the time, allowing for two obvious methods to detect deuterium fusion.[5] Here, the amount of energy does not matter; what matters is that tritium is an isotope of hydrogen with a single proton and two neutrons (tritium = T = $^3$H). Tritium is radioactive, giving off beta particles (high-speed electrons), which can be measured with a different kind of detector that measures the beta particle energy. The beta particle energy curve ultimately published by Pons and Fleischmann claiming evidence for production of tritium looked similar to that drawn in Figure 3. (It is worth noting that in the original publication, the two curves were as featureless as is shown here, which became an issue later.)

There's little hint of how long this press conference officially lasted, in part because it was apparently followed by a tour of some of the lab facilities.[6] But there is no doubt what impact this announcement had on the scientific, political, and even military worlds.

### The BYU Contribution

Pons and Fleischmann weren't the only researchers interested in the field. A physicist at nearby Brigham Young University (BYU) was also studying "cold" fusion but via different mechanisms. Word spread between the two campuses and concerns of priority and propriety began circulating.

Steven E. Jones was a physicist at BYU whose specialty was nuclear reactions; in particular, the fusion of hydrogen atoms when catalyzed by muons. Muons are short-lived particles identical to an electron, except that they have a mass 207 times larger. Because they are so much larger, muons can get closer to a hydrogen atom nucleus and even induce two nuclei closer together—close enough to fuse in some cases. This phenomenon was originally discovered in the 1950s (Huizenga 1993, 15); Jones and collaborators even published a review of muon-catalyzed fusion in *Scientific American* in 1987 (Rafelsky and Jones 1987). At the time, Jones's work was being supported by the U.S. Department of Energy (DOE), but there was talk of this support ending, in part because there seemed little future for this process as an energy source, and that programmatic support was only supposed to last a maximum of three years.

Ironically, however, in September 1988 Jones's program officer at DOE, Ryszard Gajewski, sent him a proposal from Pons and Fleischmann in which they requested funding to support further research in palladium-induced cold fusion. Over the next few months, Gajewski urged Jones to contact his fellow researchers at the University of Utah and forge a collaboration. Jones apparently did make contact in mid-December 1988 (Taubes 1993, 50). However, though there were several fits and starts, including meetings be-

**Pons and Fleischmann weren't the only researchers interested in the field. A physicist at nearby Brigham Young University was also studying "cold" fusion but via different mechanisms. Word spread between the two campuses and concerns of priority and propriety began circulating.**

Figure 4. Price of palladium ($/oz.) between March and September 1989. Source: APMEX, Inc. Graph generated at www.apmex.com; accessed July 3, 2018.

tween the researchers and their respective administrations, attempts at collaboration ultimately failed.

It was very clear to some (including Jones) that Jones's work was not in direct competition to the work of Pons and Fleischmann; for example, Jones did not measure any excess heat, and the number of neutrons he detected numbered in the hundreds at most. However, now that both research groups were aware of each other, the darker side of human nature grew in the minds of several of the people involved—culminating, ultimately, in the press conference of March 23. BYU followed up with its own press conference, focusing on Jones's less-fantastic version of fusion, on March 29,1989. Despite the more low-key approach, this announcement served to muddy things further (literally, as is mentioned below).

Figure 5. Number of citations in the Chemical Abstracts online database using "cold fusion" as a keyword. The peak occurs in 1990. The reason for the blip in 2006 has not been investigated. Data for 2018 is year-to-date.

## The Response

Because some national evening news programs carried news of the wonderful scientific advance, reaction by the scientific community was swift and thunderous.

On the one hand, there were immediate hails of congratulations for such a breakthrough by chemists with hundreds or thousands of dollars of equipment, not physicists with hundreds of millions of dollars of equipment! Even Edward Teller, a giant in the nuclear physics field, called to congratulate Pons (Huizenga 1993, 5).

Others, however, were more circumspect, many of whom were scientists who had more experience in calorimetry and nuclear science. Phone calls, emails, and faxes (only recently having become prevalent) were all pressed into service to try to get more details than the press conference provided—because the devil had to be in the details.

However, details were difficult to obtain, in part on the desire of the university and the State of Utah to protect its intellectual property. When details were forthcoming (the JEAC manuscript was published on April 10, less than three weeks after the press conference), they were either of limited help or added to the confusion. For example, even though Jones's work was originally presented as not competing with the Pons and Fleischmann claim, attempts to reproduce his work as well were stymied by the list of electrolytes in Jones's electrochemical cell: a "Mother Earth soup" (Taubes 1993, 151) mix of about ten metal salts.

Scientists, especially those with expertise in electrochemistry and, to a lesser extent, calorimetry, raced to repeat this work. So much palladium was purchased in a relatively short time that the price spiked (see Figure 4). Almost immediately researchers identified issues with the information released (and then published) by the Utah researchers, including:

- a lack of controls using non-deuterated water;
- an unrealistic gamma ray spectrum supporting neutron production (demonstrated in Figure 2); to wit, a single smooth curve is not a normal-looking gamma ray spectrum, which usually includes other features (including a Compton edge and signals from naturally present gamma rays);
- a significant lack of neutrons claimed; the amount of excess heat generated should have generated enough neutron radiation to give the researchers radiation poisoning (at the very least), yet the number of neutrons claimed was many orders of magnitude lower than expected;
- a significant lack of tritium, as well as a lack of recognition that by virtue of its production process, heavy water is slightly enriched in tritium as well.

Still, scientists did what scientists should do: try to replicate. What happened?

Mostly, they failed to replicate. Even those few who claimed to replicate produced wildly inconsistent results.

One of the earliest and most thorough critics of Pons and Fleischmann's work was Nathan S. Lewis, an electrochemist at the California Institute of Technology (Caltech). Lewis, although still in his early thirties, was already a rising star in the field of electrochemistry, having earned his PhD under Mark Wrighton, another well-known electrochemist, at MIT in 1981. Not only was Lewis well versed in electrochemistry, but he had colleagues at Caltech who were similarly adept at detecting neutrons and tritium, measuring gamma rays, and understanding nuclear processes. And they had the proper equipment and expertise in all these areas. After multiple attempts at detecting all sorts of emissions from their palladium-containing electrolytic cells, they found nothing.

In the meantime, the American Chemical Society was having its biennial National Meeting in Dallas, Texas,

in early April and hastily (and in temporary suspension of certain bylaws) organized a symposium to discuss the Pons and Fleischmann work. The symposium was eventually held in the basketball arena of the Dallas Convention Center, capacity 10,000. The symposium was held on April 12, less than three weeks after the original press conference. Several speakers preceded Stanley Pons on the podium,[7] who presented essentially the same data that had been previously released. Despite several pointed questions from the audience, he received a standing ovation from the estimated 7,000 attendees (Taubes 1993, 206; Huizenga 1993, 31–4). It might not be improper to use the word *lionized* to describe how Pons was treated by his fellow chemists.

In the weeks that followed, more and more scientists of various nationalities and specialties reported their failure to confirm the results. What follows is not an exhaustive list but gives an idea of the firepower aimed at this issue:

- Nathan Lewis's efforts (noted above), including efforts of other collaborators at Caltech, were unanimously negative.
- Steven Koonin, a Caltech theoretical physicist, theoretically modeled deuterium-deuterium fusion and predicted it to occur at a rate approximately fifty orders of magnitude (that is, $10^{50}$ times) slower than Pons and Fleischmann reported.
- Charles Martin, an electrochemist at Texas A&M University and friend of both Pons and Lewis, initially reported excess heat in heavy-water electrolysis and reported this to both Lewis and Pons. However, a few days later, he also found excess heat in light (that is, regular) water electrolysis, causing him to rethink his findings. After a significant amount of additional work, by early June he concluded that there was nothing unusual occurring and that Pons and Fleischmann were "wrong" (Taubes 1993, 300).
- Richard D. Petrasso of MIT did an extensive study of neutron capture by water and demonstrated rather conclusively (even, apparently, to the satisfaction of Pons and Fleischmann) that the gamma ray spectrum produced by the two researchers (reproduced in Figure 2) was spurious.
- The United Kingdom Atomic Energy Authority at Harwell, Oxfordshire, England ("Harwell Labs"), which had a longstanding relationship with Martin Fleischman, worked with Fleischmann to reproduce the work (in fact, after the press conference Fleischmann went to England for the Easter weekend and then went to work with Harwell scientists to share information about cold fusion). In the end, all attempts at Harwell came to nothing, and on June 15, 1989, Harwell suspended its experiments in cold fusion, having spent approximately £230,000 (the equivalent of £544,000 as of 2017, or approximately $720,000 [2017 U.S. dollars]).
- James Mahaffey at Georgia Tech Research Institute initially claimed the detection of excess neutrons but retracted that claim after it was found that the neutron detector was heat sensitive, including to the heat of the hands handling them.

**It was very clear to some (including Jones) that Jones's work was not in direct competition to the work of Pons and Fleischmann. However, now that both research groups were aware of each other, the darker side of human nature grew in the minds of several of the people involved—culminating, ultimately, in the press conference of March 23.**

- Ed Storms and Carol Talcott at Los Alamos National Laboratory claimed to see increased tritium amounts in several cells, but their experimental technique was a bit of a departure from the norm, as they intentionally contaminated their palladium electrode with sulfur. A larger issue, however, was that they apparently operated 150 heavy-water electrolysis cells but only four light-water control cells. Even though they reported increased tritium in thirteen of their 150 heavy-water cells, their results were viewed as statistically meaningless given the tiny number of controls.

Many other researchers and labs were working around the world to confirm the original results.

There were some champions, however. (Again, this is not an exhaustive list):

- Robert Huggins of the Materials Science Department at Stanford University claimed to have observed excess heat, although not as much as Pons and Fleis-

chmann did. One of his claims was that researchers who failed to replicate the results did not have the requisite materials science background (Huizenga 1993, 56). Ultimately, he became one of the most resolute non-Utah supporters of cold fusion.

**Because some national evening news programs carried news of the wonderful scientific advance, reaction by the scientific community was swift and thunderous.**

- John Bockris, an electrochemist at Texas A&M University, and a colleague of Charles Martin (see above) and his group investigated. On or around April 24, Bockris and his group got data that indicated a significant production of tritium. So much so, in fact, that it seemed to them obvious that fusion was occurring. Several days later, a few other cells showed significant tritium presence. Supporters latched on to this new evidence, Bockris included, ultimately becoming a second resolute non-Utah supporter of cold fusion. Inconsistencies in data and results from other cells suggested that instead of fusion, some of the cells were intentionally spiked with tritium to satisfy the expectations of the research advisor (Huizenga 1993, 114–129; Taubes 1993, 326–327).

### Later Developments

On May 1 and 2, 1989, there was a special session on cold fusion at the American Physical Society (APS) meeting in Baltimore, Maryland. Unlike the reception at the chemistry society meeting less than three weeks previous, at this meeting there was a lot more evidence (most of it negative) to consider, and the reception toward cold fusion was skeptical, if not hostile. (Neither Pons nor Fleischmann attended despite both being invited.) Jones from BYU spoke, presenting his results and again reiterating that his results were different from the claims out of the University of Utah. But then Koonin and Lewis, both from Caltech, spoke and delivered what can only be described as a scientific one-two knockout punch. Another standing ovation occurred.

But it wasn't over; a week later, on May 8, the Electrochemical Society (ECS) held its Spring Meeting in Los Angeles. Both Pons and Fleischmann attended, determined to defend their work. Caltech's Lewis also attended. The mood was not as negative as at the APS meeting, but the overall tone was still very critical of the original work. There were some supporters of cold fusion at the ECS meeting (Huggins and Bockris among them), but their claimed positive results were inconsistent. The fact that Pons and Fleischmann were speaking to fellow electrochemists and apparently failed to win converts was very telling.

About two weeks later was a third conference devoted to cold fusion, this time organized by Los Alamos National Lab and the Department of Energy, which was held in Santa Fe, New Mexico, on May 23–25, 1989. Members of the Energy Research Advisory Board (ERAB), a committee appointed by the Department of Energy to formally evaluate the cold fusion claims, were present. Pons and Fleischmann declined to attend. It was, as ERAB chairman John R. Huizenga reported, "a most unusual scientific conference where experimental claims were contradictory and chaotic" (Huizenga 1993, 75). Most of the attendees reported null or negative results, and those attendees who claimed positive results weren't reproducing each other, a classic sign of negative results.

This meeting did result in ERAB deciding to visit some of the principals of cold fusion, which they did. Ultimately the visits were, in a word, "disappointing" (Huizenga 1993, 87), especially given the fact that they were never shown a working cold fusion cell at any visit! After these visits, ERAB met to construct their final report, which was issued in November 1989. It was negative on all counts and recommended against investing large amounts of money and time on further investigations.

Still cold fusion lingered. Despite the overwhelming evidence against cold fusion, the State of Utah opened the National Cold Fusion Institute (NCFI) in August 1989 with its promised $5 million. However, after fits and starts, and after all attempts to re-energize cold fusion as a legitimate process, the Institute closed on June 30, 1991. Experiments continued around the world, mostly by believers, but no smoking gun has ever been identified.

### Denouement

Currently, the predominant view among scientists is that cold fusion does not exist—at least, not at the level claimed by Pons and Fleischmann or their supporters. However, even today there is a low level of interest in cold fusion and related phenomena, now euphemized as "low energy nuclear reactions" (LENR). Although mostly relegated to conferences and even journals of its proponents' own making, the subject does occasionally appear at an ACS or APS meeting. Publications have dropped off significantly but not entirely, as shown in Figure 5, although it could very well be that citations

of cold fusion are done more as part of historical background rather than current research.

What happened to the three main characters: Jones, Pons, and Fleischmann? Jones remained at BYU and continued studying muon-catalyzed fusion. After September 11, 2001, he joined the side of the 9/11 conspiracy theorists, claiming that jet fuel fires could not melt the steel beams of the Trade Center buildings, arguing for demolition instead. After investigations into his 9/11 claims at BYU, Jones took early retirement and has apparently dedicated himself to that topic. Blogs on at least one website purported to be written by scholars searching for "9/11 truth" were still active as of late 2016.

In October 1990, Pons's attorney faxed a request for a sabbatical for his client, but it was denied. Pons retired from the University of Utah effective January 1, 1991, and subsequently moved to France, where he eventually obtained French citizenship. There, he worked with Fleischmann on cold fusion–related work that was sponsored by the Technova Corporation, a subsidiary of Toyota. The work was shut down in 1998, and as of this writing Pons remains in France.

Fleischmann moved back to his home in England but continued to work with Pons in the French lab. He remained active as a publishing scientist, collaborating with American and European researchers. He died on August 3, 2012, in England at the age of eighty-five from natural causes.

## Lessons

Despite the low level of continued work in this area, cold fusion is now considered a classic example of pathological science as defined by Irving Langmuir in a talk given at the Knolls Research Laboratory in Niskayuna, New York (Langmuir 1953). It has been discussed in detail by Huizenga (1993), so it will not be reiterated here. To those who would argue that the cold fusion affair is an example of what is wrong in science, I would concede that they are partly correct. Space prohibits the inclusion of more details here, but a reading of those details in the several books on the subject (see the references) makes it clear that certain obvious deviations of the regular scientific process occurred, leading up to and including the original March 23 press conference, and continued long after. A lot of things went wrong that should not have, and would not have, had the proper standards of scientific inquiry been followed.

To those who argue that the cold fusion affair is an example of what is right in science, I would also agree (and would, overall, take this side). Despite the obviously unorthodox way the cold fusion events began, scientists ended up doing what scientist do: they tried to understand and replicate the work, and when not able to do so, said so and even criticized the original results. In the end, *science worked*. There was an expenditure of a large amount of time and money and effort, but I would argue that the resources utilized were commensurate with the importance of the claim. We now have a better understanding of what works and *what does not work*, and most of us who lived through the process have moved on. If there is any positive aspect to the entire affair, it should continue to live on as a classic example of What Not to Do in Science. ■

## Notes

1. Heavy water is water comprising deuterium atoms instead of hydrogen atoms. Deuterium is an isotope of hydrogen whose nucleus contains one proton and one neutron, as opposed to the single proton only for "normal" hydrogen atoms. Because it has almost twice the mass as regular hydrogen, water comprising deuterium is called "heavy" water.

2. While an unusual effect, the absorption of hydrogen by palladium metal is a well-known phenomenon and has been the subject of much study by various interests, including the development of hydrogen storage devices for fuel cells.

3. My first exposure to the manuscript was as a fax that was received by the research group I was working in as a postdoctoral researcher with at the Lawrence Berkeley (now Lawrence Berkeley National) Laboratory. Fax machines, in addition to email, were only then becoming widespread.

4. MeV = megaelectron volt. 1 MeV = $1.602\times10^{-13}$ J. This may not seem like a lot of energy, but it's enough energy to break about two *million* chemical bonds.

5. A third reaction, production of $^{4}$He and a gamma ray photon, has a much lower possibility of occurrence (Huizenga 1993) and can be ignored here.

6. A truncated video of the press conference on YouTube is just under thirty-nine minutes long.

7. As a fellow of the American Chemical Society, I have requested but not yet received any information about that symposium.

## References


Collins, H, and T. Pinch. 1994. *The Golem: What Everyone Should Know about Science*. Cambridge: Cambridge University Press.

Fleischmann, M., and S. Pons. 1989. Electrochemically induced nuclear fusion of deuterium. *Journal of Electroanalytical Chemistry* 261 (2A): 301–308.

Huizenga, J. 1993. *Cold Fusion: The Scientific Fiasco of the Century.* Oxford: Oxford University Press.

Kikuchi, M., K. Lackner, and M.Q. Tran. 2012. *Fusion Physics* Vienna: International Atomic Energy Commission.

Langmuir, I. 1953. Seminar at Knolls Research Laboratory, Niskayuna, New York. Transcript available online at https://www.cs.princeton.edu/~ken/Langmuir/langmuir.htm; accessed July 5, 2018.

Rafelsky, J., and S.E. Jones. 1987. Cold nuclear fusion. *Scientific American* 257 (1): 84–9.

Taubes, G. 1993. *Bad Science: The Short Life and Weird Times of Cold Fusion* New York: Random House.

University of Utah. 1989. Simple experiment results in sustained N-fusion at room temperature for first time (press release). Available online at https://www.colorado.edu/physics/phys3000/phys3000_sp16/handouts/64_ColdFusionPressRelease.pdf; accessed June 2018.

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# Why E-Cat Is a Hoax

Energy Catalysis, or E-Cat, claims to generate nuclear energies on a tabletop—a scientifically impossible feat. Nonetheless, its inventor, Andrea Rossi, has fooled companies into investing in it.

SADRI HASSANI

Calling something energy catalysis (E-Cat), low-energy nuclear reactions (LENR), or condensed matter nuclear science (CMNS) cannot hide the fact that the idea is simply the same cold fusion announced to the press in March 1989. As cold fusion was notoriously debunked by the scientific community in the 1990s (Close 1991; Huizenga 1994; Taubes 1993; see also David W. Ball's article in this issue), new names such as these popped up to conceal the true identity of the idea. The underlying physics on which all these processes are based is nuclear fusion. (To grasp the absurdity of the claims, it helps to have a nodding familiarity with the basics of nuclear interactions; I discuss those in the box on page 38.)

## How E-Cat Is Alleged to Work

E-Cat is the brainchild of Andrea Rossi, a self-proclaimed inventor with a master's degree in philosophy and a degree in chemical engineering from the University of Kensington in California, which was subsequently identified as a diploma mill and shut down (Holguin 2004). He has demonstrated his E-Cat generators to audiences around the world but has not revealed how all the black boxes composing his machine work (Krivit 2011). The only thing we know about the E-Cat generator is that it is a cell consisting of nickel and hydrogen. This was not directly revealed by Rossi but became known after he challenged his competitor's patent (E-Cat World 2015; see https://patents.google.com/patent/EP2702593B1/en). The details of how the patent allegedly accomplishes cold fusion is given in blog posts—as is the entire literature on cold fusion and LENR (see https://e-catworld.com/, http://news.newenergytimes.net/, https://animpossibleinvention.com/, and http://www.quantumheat.org/index.php/en/).

Andrea Rossi

Journalist Steve Krivit maintains a blog containing the most comprehensive information about LENR (of which he is an advocate) and cold fusion (of which he is an adversary). No credible physics or chemistry journal is cited there, because no such journal is willing to publish articles that are not based on science. The fight between LENR believers and cold fusion advocates is not unlike that between two factions of a religion with opposing views. While members of the cold fusion community believe they achieve fusion by orbital capture (as in the process of muon capture by hydrogen discussed in the box on p. 38), the LENR community invoke weak nuclear interaction.[1]

How does Rossi's E-Cat cell work? Mats Lewan (2016), a Swedish journalist with no physics or chemistry background but with a passionate devotion to cold

try background but with a passionate devotion to cold fusion, proposes a "theory" whereby a hydrogen atom with an extra electron ($H^-$) replaces one of the electrons of the nickel atom, and since $H^-$ is 2,000 times more massive than the electron, it gets much closer to the nickel nucleus in the same manner that the muon captured by a hydrogen atom reduces the size of the resulting muonic hydrogen. As a confirmation of his theory, Lewan mentions the X-ray burst "produced in a replication attempt of the E-Cat" reported—not in a scientific journal but instead in a YouTube video (Martin Fleischmann Memorial Project 2016). According to Lewan's theory, the captured $H^-$ loses its electrons (through some unexplained mechanism) and the resulting proton fuses with the nucleus of nickel. Lewan claims that this process is similar to the muon-catalyzed fusion. There are several things wrong with this claim. First, in the muon-catalyzed fusion, the nuclei of the muonic hydrogen *molecules* fuse. Muons do not fuse with the hydrogen nucleus.[2] Second, if the proton is captured by the nickel nucleus (with twenty-eight protons and thirty neutrons), it has to turn into copper (with twenty-nine protons and thirty-four neutrons). Therefore, the proton must have a tremendous amount of energy—such as that provided in a large particle accelerator—to create the extra four neutrons. Third, nickel is at the bottom of the stability curve shown in the box on p. 38. Hence it cannot participate in either fission or fusion. Just as you need energy to move a ball at the bottom of a bowl, you need to provide energy to move from nickel to copper.

### Comparison with Real Science

A unique characteristic of real science is the impact it has on science itself and, more tangibly, on technology. The following list is only a small sample of this characteristic. Note that all discoveries listed had at least one impact that occurred *less than thirty years* after the discovery.

- Maxwell predicted the electromagnetic waves (EMWs) in 1865. They were produced in the laboratory in 1887, and in 1901 radio was invented.
- Quantization of electromagnetic waves was proposed in 1905. Eight years later, it was used to explain the spectral lines of the hydrogen atom.
- Einstein discovered his general theory of relativity in 1916. It immediately explained the precession of the perihelion of Mercury and predicted—among other things—the bending of light, which was observed in 1919. Gravitational waves, another prediction, were observed recently. The general theory of relativity also predicted gravitational time dilation, which is crucial in the design of GPS devices.
- The wave properties of the electron were proposed in 1923. Eight years later the first electron microscope was built.
- Quantum mechanics was theorized in 1925–1926.
  - It immediately explained the spectral lines of the hydrogen atom.
  - It accounted for the periodic table.

**The fight between LENR believers and cold fusion advocates is not unlike that between two factions of a religion with opposing views.**

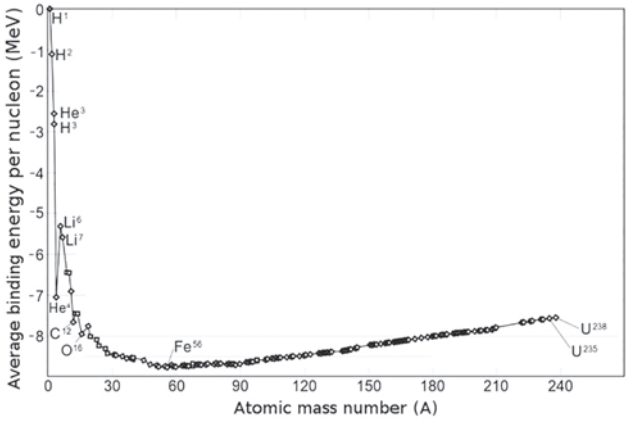
  - A year later, it was used to describe the hydrogen molecule.
  - Two years later, it was combined with special relativity to create relativistic quantum mechanics, which predicted the existence of antimatter and is now at the heart of the fundamental forces of nature and the standard cosmological model.
  - Six years later it was used to explain nuclear alpha decay.
  - Twenty-one years later, it prompted the invention of transistors.
  - Twenty-eight years later, it was used to invent masers, the prototype of laser, which were first produced in 1960.
  - Chemists have used quantum mechanics to synthesize countless materials from polymers and plastic to paints, detergents, and drugs.
- The helical nature of DNA was discovered in 1955. Seventeen years later, the first recombinant DNA was produced, which led to the far-reaching field of genetic engineering. Twenty-five years later it was employed in solving a crime. Today, forensic science is almost entirely based on DNA evidence. DNA has become an indispensable tool in archeology, paleontology, and zoology.

It has been almost thirty years since Pons and Fleischmann, in a press conference, abnormally reported cold fusion. No other scientist has been able to reproduce

## Remarks on Nuclear Interaction

The stability curve of nuclei—a plot of average binding energy (BE) per nucleon (proton or neutron) versus the atomic mass number shown below—tells us how the two exothermic (energy releasing) nuclear processes, fission and fusion, work. In either case, the higher BE on either side of the valley turns into the kinetic energy (KE) of the final products with lower BE (closer to the valley). Fission accomplishes this by triggering heavier elements on the right. In fusion, two light elements on the left combine into heavier elements. Think of the curve as a bowl with a ball inside. If the ball is not at the bottom of the bowl, it moves toward it whether we release if from the right or the left. If the ball is at the bottom, it will not move *unless we provide energy* to it. Since fusion is the alleged underlying process of E-Cat, a brief introduction of that topic will be helpful.

Stability Curve of Nuclei: The Lower the Position, the More Stable the Nucleus




Nuclei repel each other electrically unless they are so close that the *attractive* nuclear force, which operates only within the nucleus, dominates. Classically, this requires the two nuclei to touch each other. To achieve this, they should be moving at an extremely high speed. It is known, however, that at the core of stars such as the Sun, hydrogen nuclei (protons) fuse at much lower speeds. This was a

their results. Aside from the claims of the cult of believers, no invention or actual production of energy has been made. Dick Smith, a CSI fellow in Australia, has offered one million dollars to Rossi to demonstrate his generator in the presence of unbiased observers (Smith 2012; see box on p. 40). Rossi has declined the offer, saying that customers can judge whether or not his invention works. However, no customer has surfaced to validate the operation of E-Cat. On the contrary, one customer has filed a lawsuit, claiming that the invention is bogus (Lawsuit 2016). The competition between LENR and cold fusion has had the benefit of releasing a huge amount of information on Rossi's folly. For a timeline of events, see http://tinyurl.com/7zjn8kr.

**With all the scientific evidence against it, why do people fall for cold fusion? The short answer is science illiteracy.**

### Falling for Cold Fusion and E-Cat

With all the scientific evidence against it, why do people fall for cold fusion? The short answer is science illiteracy. The public, while enjoying the technology that is fundamentally based on modern science, is deplorably illiterate in the basic premises of science such as verifiability, repeatability, and evidence. Improving the science literacy of the public may reduce its gullibility, but other factors—especially those originating from scientists themselves—cannot be ignored. Ever since its birth, quantum mechanics has been infested with mysticism, especially of the Far Eastern kind, because of the philosophy of its founders. Bohr, Heisenberg, Pauli, and Schrödinger were all influenced by Arthur Schopenhauer, whose philosophy paralleled Buddhism and Hinduism. It is not an exaggeration to say that physicists themselves have delivered the most devastating blow to science literacy and the flourishing of modern pseudoscience.

John Archibald Wheeler was arguably one of the most brilliant theoretical physicists of the middle of the twentieth century. Although he did not win a Nobel Prize, he supervised forty-six PhD students at Princeton University, two of whom won the Prize: Richard Feynman, the noted American physicist, for his contribution to quantum electrodynamics, and Kip Thorne for his role in the design and construction of the LIGO detector and the observation of gravitational waves. There was another side to Wheeler, which often prodded him to speculate on matters outside science. Freeman Dyson, a long-time friend and a fellow speculator—whose speculation won him the Templeton

Prize in 2000—describes Wheeler as both "prosaic and poetic" (Barrow et al. 2004, xviii).

Wheeler and two of his students wrote a book titled *Gravitation* (Misner et al. 1972), a masterpiece that has taught Einstein's general theory of relativity to generations of physicists. Throughout the book, the prosaic Wheeler helps explain the intricacies of the theory with a peerless combination of clarity and rigor. Then, on page 1217, the poetic Wheeler breaks his silence:

> ... May the universe in some strange sense be "brought into being" by the participation of those who participate? ... "Participator" ... strikes down the term "observer" of classical theory, the man who stands safely behind the thick glass wall and watches what goes on without taking part. It can't be done, quantum mechanics says. ... Is this firmly established result the tiny tip of a giant iceberg? Does the universe also derive its meaning from "participation"?

Unsurprisingly, this particular admixture of quantum mechanics and mysticism has become a powerful tool for pseudoscientists to consociate their nonsensical ideas with science. If the universe is "brought into being by the participation of those who participate," they argue, then you, as a participator, create the universe. And since "the universe derives its meaning from your participation," you and the universe become the same: *You Are the Universe*. It is not a coincidence that Deepak Chopra and Menas Kafatos chose those words for the title of their recently published book, which predictably and regrettably became a bestseller in no time.[3]

Wheeler is only one of an appreciable number of scientists who step out of their field of expertise and speculate on spiritual and religious matters—*and base their speculations on their science*. This confluence of science and pseudoscience by scientists is inarguably the most pernicious blow to scientific literacy. Just type "quantum spirituality" in the Amazon.com search field to obtain several hundred titles, including such outlandish titles as *Quantum Angel Healing*, *Quantum Tarot Cards*, and *Quantum Activism*.

The CEOs and the decision-makers of corporations are, like the general public, not the most critical thinkers of the world.[4] They are most likely avid readers of self-help books on one variation of "positive thinking" or another and firm believers in its fundamental basis, namely the all-embracing and pretentious "law of attraction."[5] Benefiting from the speculative teachings of the likes of Wheeler, the promoters of the "law of attraction" can claim a link between their profession and quantum mechanics.

Indoctrinated in this culture of pseudoscience, the CEO of an energy company hears about an inventor achieving fusion on a tabletop. He "researches" the claim, and his positive thinking, coupled with the likelihood of the enormous profit promised by the invention, ignores all the negative scientific critique of the invention and invests in cold fusion.[6] And if a Nobel laureate such as Brian Josephson affirms the possibility of cold fusion, no doubt it will remain in the CEO's mind.[7]

The believers and promoters of E-Cat and LENR resort

puzzle until quantum mechanics, through the phenomenon of *tunneling*, allowed fusion at larger distances and, therefore, lower speeds. There are two ways to bring two light nuclei together: by accelerating them (hot fusion) or by making very small atoms so that the distance between the nuclei of the *molecule* formed by those atoms is very small (cold fusion).

Quantum mechanics gives only the probability of fusion, which is expressed in terms of cross section.[8] Bigger cross sections correspond to higher probability of fusion. At the core of the Sun, hydrogen nuclei fuse with a small cross section: it takes about ten billion years for the hydrogen in the sun to fuse (Krane 1987, 537). While this prolongs the life of the Sun and the possibility of life on Earth, it makes protons bad candidates for man-made fusion. Plots of fusion cross sections (McCracken and Stott 2005, 38) show why deuterium-tritium fusion at about 100 keV is the process of choice in fusion laboratories around the world. Deuterium is abundant in the oceans, and tritium can be produced in situ.

The second way of bringing the nuclei closer is by forming muonic hydrogen molecules. Muon is basically a heavy electron. Replacing the electron in the hydrogen atom by a muon shrinks the size of the atom by a factor of almost two hundred. So, the two nuclei in a muonic hydrogen *molecule* are almost two hundred times closer to each other than a regular hydrogen molecule and, thus, more likely to fuse. Although the fusing of muonic hydrogen molecules has been observed in the laboratory, this kind of fusion cannot be a source of energy because the production of muonic hydrogen requires more energy than the energy outputted in the subsequent fusion. Nevertheless, all claims of cold fusion rely on processes similar to this.

*—S. Hassani*

to one of the most effective means by which untruth is propagated among the public: conspiracy theory. In the conspiracists' view, just as the mainstream media have conspired to withhold the truth about what really happened on 9/11, to stay silent about the fact that the Sandy Hook massacre was staged, to not cover the fact that millions of people voted illegally in 2016, so have the mainstream scientific journals conspired not to publish any of the breakthroughs in cold fusion and LENR. The public is in fact more prone to the scientific conspiracy theory than its political counterpart. While the latter enters the daily life of the public and, therefore, has a tangible effect on it, the former is too abstract. If John Doe can be made to believe that the Las Vegas shooting never occurred and all the fuss in the news media was simply a performance by paid actors, he can more effectively be indoctrinated into believing that parapsychology is a science, that near-death experiences indeed happen, that prayer can cure cancer, and that cold fusion, LENR, and E-Cat are possible.

Thus, to answer the question of why the public and CEOs of reputable corporations succumb to scientifically disproven nonsense, we have to ask another—more significant—question: Why do great scientists believe in ideas that contradict their science? There is no obvious answer. Perhaps they are so enthusiastic about publicizing the "excitement" of their discovery that they feel that peppering it with some exotic—albeit nonsensical—ideas may raise the interest of the public. Perhaps, as in the case of Brian Josephson, something happens in their lives that alters their personality and annuls their rationality. Perhaps their philosophical outlook is so strong—as with the founders of quantum mechanics in the 1920s and 1930s—that any novel scientific discovery becomes an excuse to inject that outlook into their science. Or perhaps public recognition, profit from books that appeal to the public, and million-dollar awards such as the Templeton Prize are too enticing to ignore. Whatever the reason, it is the responsibility of science educators to tell the public that science is not the same as scientist: *It is the message that counts, not the messenger*. ■

## Dick Smith's Challenge to Rossi

In August 2018, Roger Green, the Australian agent/distribution holder for the Rossi E-Cat, issued a press release about Australian businessman and CSI Fellow Dick Smith's challenge to their claims (Smith 2012). Here is the text of their release:

**ONE MILLION prize money**
**for Rossi's Ecat independent validation**

A famous Australian benefactor and entrepreneur, Dick Smith, is willing to award Andrea Rossi one million USD to support the progression of the Ecat technology

All that is required is a public demonstration at an mutually agreed reputable university... An independent assessment of the energy inputs and outputs of the Ecat reactor, with specific care around wiring and measurements of the output power.

It will be 100% secure and there is no need to reveal how the reactor works, or what is inside the reactor.

*For more details*
Contact Roger Green
Ecat@earthlink.net
www.Ecat.Tech

**Who is Dick Smith**
Dick Smith is one of Australia's most notable people, having become famous as an entrepreneur and business man and then cementing that as a record breaking aviator, philanthropist, author, environmentalist and political activist. He was awarded Australian of the Year in 1986.

Ref:
https://en.wikipedia.org/wiki/Dick_Smith_(entrepreneur)

Green also told Smith on August 26 that the prize challenge had been passed on to Rossi, but "Rossi was extremely busy (like always) in building a 40 MW plant and is not interested in the prize." In other words, he declined the challenge.

## Notes

1. The claims of how the weak nuclear force is responsible for LENR are based on erroneous speculations that violate some fundamental principles of weak interactions. However, debunking LENR is not the intent of this article.

2. The real analogue of muon-catalyzed fusion is for the nickel atoms to form a molecule. This is impossible because there is no such thing as a nickel molecule. And even if there were, two nickel nuclei never fuse, because nickel is in the valley of the nuclear stability curve.

3. For a critical review of this book and its exploitation of Wheeler's participatory dogma, see Skeptical Inquirer March/April 2018, p. 62.

4. Steve Jobs believed in the nonsensical "Reality Distortion Field." He refused conventional medical treatment, preferring alternative medicine, which caused his eventual death.

5. A highly recommended book on the impact of self-help culture and positive thinking is Barbara Ehrenreich's *Bright-Sided: How Positive Thinking Is Undermining America* (Picador, 2009).

6. Japan's Ministry of International Trade and Industry spent $25 million on cold fusion in the early 1990s. About fifteen Japanese companies took part in the effort and contributed additional money (Pollack 1992). However, five years later the Government of Japan terminated its research, which had failed to confirm that cold fusion existed (Pollack 1997).

7. Brian Josephson was a brilliant physicist, who in 1962 mathematically described an effect now bearing his name, for which he won the Nobel Prize in 1973. Something happened to him right around that time that shifted his interest in science to parapsychology, mind-matter unification, transcendental meditation, E-Cat, and other paranormal phenomena. In 1974 he angered scientists during

a colloquium of molecular and cellular biologists in Versailles by inviting them to read the Bhagavad Gita and the work of Maharishi Mahesh Yogi and by arguing about special states of consciousness achieved through meditation (see https://en.wikipedia.org/wiki/Brian_Josephson#Early_interest_and_transcendental_meditation and http://www.tcm.phy.cam.ac.uk/~bdj10/).

8. Cross section is not just a quantum mechanical concept. It can also be defined in classical mechanics. Fire bullets at a bowling ball. If the distance of the bullets from the center of the bowling ball as they pass it is larger than the radius of the ball, they miss it; if smaller, they interact with it. So, we say that the cross section of the interaction of bullets with the bowling ball is simply the area of the circle seen by the bullets as they pass the bowling ball.

## References


Barrow, J.D., P.C.W. Davis, and C.L. Harper, Jr. eds. 2004. *Science and Ultimate Reality: Quantum Theory, Cosmology, and Complexity*. Cambridge, MA: Cambridge University Press.

Close, F. 1991. *Too Hot to Handle: The Race for Cold Fusion*. Princeton, NJ: Princeton University Press.

E-Cat World. 2015. Piantelli European Patent Revoked after Challenge by Leonardo Corporation. Available online at http://e-catworld.com/2015/09/30/piantelli-european-patent-revoked/.

Holguin, Jaime. 2004. Top officials hold fake degrees. *CBS News* (May 10). Available online at https://www.cbsnews.com/news/top-officials-hold-fake-degrees/.

Huizenga, J. 1994. *Cold Fusion: The Scientific Fiasco of the Century*. Oxford: Oxford University Press.

Krane, K. 1987. *Introductory Nuclear Physics*. New York: Wiley.

Krivit, S. 2011. The Failure of Rossi's Energy Catalyzer, Caught on Video Parts 1 and 2. Available online at https://www.youtube.com/watch?time_continue=9&v=m-8QdVwY98E and https://www.youtube.com/watch?time_continue=4&v=YrTz5Bq6dsA.

Lawsuit. 2016. Available online at http://newenergytimes.com/v2/sr/RossiECat/Rossi-vs-Darden/20160806-Darden-Countersuit/20160806-Darden-Countersuit-29-0.pdf.

Lewan, Mats. 2016. Finally: This Is Possibly How the E-Cat Works. Available online at https://animpossibleinvention.com/2016/03/07/finally-this-is-possibly-how-the-e-cat-works/.

Martin Fleischmann Memorial Project. 2016. Implications of Signal, Seeing into the E-Cat with X-Ray Eyes. Available online at https://www.youtube.com/watch?v=MfTeHU4vBmc&feature=youtu.be.

McCracken, G., and Peter E. Stott. 2005. *Fusion: The Energy of the Universe*. New York: Elsevier.

Misner, C., K. Thorn, and J.A. Wheeler 1972. *Gravitation*. Princeton, NJ: Princeton University Press.

Pollack, Andrew J. 1992. Cold fusion, derided in U.S., is hot in Japan. *New York Times* (November 11).

———. 1997. Japan, Long a Holdout, Is Ending its Quest for Cold Fusion. *New York Times* (August 26).

Smith, Dick. 2012. Email to Andrea Rossi. Available online at http://newenergytimes.com/v2/sr/RossiECat/Solihin-Millin/SmithOffer.pdf.

Taubes, G 1993. *Bad Science: The Short Life and Weird Times of Cold Fusion*. New York: Random House.

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# The Sputtering Engine of Creator Belief

Far from belief in a supernatural creator being a natural consequence of the way our brains work like language, materialism, and sex, it is an easily cast-off opinion quickly losing ground in the United States and much of the world.

GREGORY S. PAUL

*This article was stimulated by two articles and a commentary in a recent issue that the author feels insufficiently noted dramatic declines in religious belief. He offers his arguments and analyzes the data on those declines in this article. Following it we present an extended comment from one of our original authors, James E. Alcock. —The Editors*

In the September/October 2018 Skeptical Inquirer, three articles made related mistakes. One, by James Alcock, was based on the common belief that religion is highly popular and enduring because it is a natural consequence of the way brains work from childhood on up. Gregg Davidson and company asserted that because little if any progress is being made concerning the popularity of creationist belief versus evolutionary science in the United States, effective methods must be urgently developed and deployed to improve the situation. Third, Lorence Collins stated that nearly half of Americans think our planet is just ten millennia old.

Science Advocacy | Telepathy Investigation | Homeopathy Challenge | Vagina Quackery | Millennials and Astrology
Skeptical Inquirer
THE GOD ENGINE
HOW BELIEF DEVELOPS
James E. Alcock
Cosmos Season 2: On the Set
Nine Biological Reasons Noah's Flood Never Happened
Multi-Level Marketing Schemes
Radiation and Rationality: Facts vs. Fears
Algorithms Aren't Oracles

As for the first assertion, to confirm that juvenile-derived cognition plays a big role in the popularity of theism in adult populations, the hypothesis must be compatible with and convincingly explain the large-scale demographics of atheism and theism. Yet Alcock presents no statistical data relevant to the popularity of theism versus atheism either longitudinally over time, or laterally over nations, to confirm or deny his psychology-based hypothesis. It is a hypothesis that would not be taken seriously in, say, Denmark, where most are casual atheists to one degree or another. As for Davidson et al., they failed to cite the survey results showing that support for Darwin's Dangerous Idea is rising rapidly at the expense of creationism in these United States and is doing so largely because American atheism is growing by leaps and bounds in direct contradiction to the errant idea that religion is the normal human condition. Nor does survey data support Collins's contention that so many Americans are so profoundly deluded.

There certainly are mental items that are truly universal and natural to at least reasonably healthy adult human minds and necessary for societies to function. These include sophisticated language skills, which all capable adults must and do have to get along in society and which all competent adults must possess if societies are to function on a daily basis. That's a reason we have really big, complex brains and why we have such sophisticated vocal tracts. Another universal human item is materialism, the desire to create and possess stuff. That is another reason we have such big brains and is why we have opposable thumbs. Also nearly universal is the desire for sex—without that it's hard to reproduce the species.

The premise that almost all humans are inherently religious stems to a great extent from the thesis that children are highly gullible for assorted reasons, including overactive pattern recognition that leads to unsubstantiated but often ardent belief in undetectable, magical things such as deities, which is true, followed by the assumption that adults are highly prone to retaining juvenile gullibility, which is exaggerated to the point of an unsubstantiated mythology. The reason we don't allow kids to run societies is because they are too immature to do so. The reason we have mentally competent adults to run societies is because for all our failings most of us are not *that* gullible. Another problem with the hypothesis that mass religion stems from children being automatically prone to magical and supernatural thinking is that they are taught such notions by adults, so it is more likely that kids are being contaminated by grownups than the reverse.

Scientifically testing the problem is not at all hard to do. For theism of some form or another to be truly universal to human brains like language, materialism, and sex are, it must be consistently the near total opinion of all societies over all of time, with atheism being rare and hard to get to. And if juvenile cognition is critical to mass theism, then religiosity should tend to decline with the rising maturity of increasing age. If, on the other hand, the degree of theism is highly variable among societies, then adult atheism tends to be highest among youth, and being an atheist is not all that hard or is even the easy option among many—if not most—in societies where atheism is not imposed by atheistic dictatorships. Religion, then, abjectly cannot be the universal, natural condition for the species, and all theories as to why we are strongly predisposed to be pious—including children as magical thinkers—are automatically false or at least exaggerated.

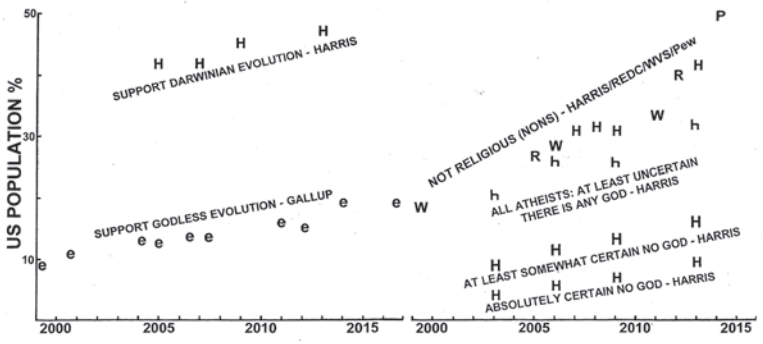
It's not like the data are not on hand to determine the reality. We all know these days that levels of atheism and theism vary tremendously in democratic societies, with some being highly atheistic (Norris and Ingelhart 2004; Paul 2009; Paul 2010b; Zuckerman 2008; Rees 2009; Barber 2011; Bruce 2011). Sociologist Phil Zuckerman (2008) spent time in Denmark, where around half are atheists of some sort or another and most of the rest are not ardent believers. His interviews of Danes found that most really did not care all that much about matters theist or atheist; it was of little import to them. Spain and Germany are at least as nonreligious; the Netherlands, France, Japan, and Sweden even more so. Belief in an afterlife is on the wane—all this despite the lack of a major organized atheistic movement and in the face of organized theism. The churches of the developed democracies have largely emptied out, and as Eurosociologist Steven Bruce (2011) has shown, the great majority of those losing their Christianity are not turning to alternative spiritualities.

To the best of my knowledge, brain function is about the same in Spain, Germany, Holland, France, Japan, and Sweden as in, say, the United States. There is no mention by Alcock of the tremendous disparity in popular nonreligiosity in developed democracies that absolutely falsifies the premise that religious supernaturalism is the natural consequence of how human brains work. Also unmentioned is how the popularity of atheism/theism varies tremendously between Manhattan and San Francisco versus Birmingham and Tulsa. There is a long-standing myth that the United States will always be highly religious. This is not true. Surveys were observing a slide in Amerotheism in the late 1900s. Nowadays it is more like an avalanche. In this century, Harris (2013), RedC (2012), PRRI, World Values Survey, Pew (2015a), GSS, Gallup—in surveys titled "American's Belief in God, Miracles and Heaven Declines," and "Nones on the Rise"—are all measuring spectacular increases in irreligion, with those who lack religion soaring from around 30 to some 40 percent of the population in just a decade or so. That's ten percent of the total population losing their religion in just ten years, probably the maximal rate possible! Americans are notoriously reluctant to admit irreligiosity, and Pew (2014) has calculated that half of Americans actually qualify as nonreligious, with two thirds of millennials being such; that *young* adults are the least religious is not in line with the thesis that the magical thinking of childhood is a primary cause of adult religiosity. Harris (2013) found that those who are at least marginally atheist (in that they are not at least somewhat certain God exists) rose from a fifth to a third in just a decade. A study designed to account for Americans' tendency to underreport their atheism, as well as modern polling issues that make it harder to sample irreligious youth (Pew 2010), confirms that about a quarter or more are probably atheists of some level (Gervais and Najle 2018). On the corresponding downslope are church membership and attendance, with studies indicating that only a quarter or less of Americans attend church on a regular basis. Alcock makes no mention of this remarkable proof that religion—not language, materialism, or sex—is easy to lose among the masses.

This includes the global masses. According to RedC (2012) as well as World Values Survey stats, the nonreligious rose from around 30 to 40 percent across the globe in about a decade. Don't be fooled by the ongoing rise of the religious hard Right; that's a reactionary counteraction to an increasingly secular world (Paul 2012).

It is not just modern nation states that exhibit varying levels of religiosity. Levels of theism vary greatly among surviving hunter-gatherer tribes, with the likes of the Hadza,

Rising Support for Evolution, Atheism, and Nonreligion




**Alcock presents no statistical data relevant to the popularity of theism versus atheism either longitudinally over time, or laterally over nations, to confirm or deny his psychology-based hypothesis.**

Mbuti, Aka, Siriono, and Botocudo lacking belief in an afterlife and shamans and not having much in the way of rituals (Paul 2010a; Paul 2012; Peoples et al. 2016). It is possible, if not probable, that many prehistoric tribes were similarly religious minimalists. Lacking major gods popular among the masses and large-scale organized priesthoods, the Chinese civilization has always been much less religious than its deeply theistic Indian counterpart.

The real question is not why adults are not religious but why they so often are—after all, there is no actual compelling evidence that any gods exist. Because being religious is nowhere close to being as universal as the things our brains are actually genetically preprogrammed to do—all that talking, making and getting stuff, and having intercourse—it has to be outside environmental influences that are largely responsible. The main factor is socioeconomics. It is not an accident that the 10 percent of the total population increase in the global nonreligious closely tracks with the planetary rise in the middle class. I and others have published peer-reviewed technical studies showing that the better off the people in a first world nation are in most socioeconomic factors, the less religious they tend to be.

That makes real psychosociological sense. When people are chronically stressed and anxious because life is persistently difficult—the status of most people over human history—there is a temptation to mentally self-medicate by appealing to speculative supernatural entities to alleviate that anxiety, in the hope that the extraordinary powers will improve the discontented daily lives and offer a superior afterlife. Conversely, dramatically reduce the chronic anxiety by placing the great majority of a population in a prosperous, secure modern middle class, and most casually lose interest in seeking the aid and comfort of dubious deities that science has removed the intellectual need for (Norris and Inglehart 2004; Paul 2009; Paul 2010b; Paul 2012; Zuckerman 2008; Rees 2009; Barber 2011; Bruce 2011).

To that add how for the past two centuries the corporate-consumer-industrial complex in its constant drive for profits and desire for material things has been working to convert frugal, tithing, church-going, spiritual, square, sexually repressed citizens into hedonistic, hip, sex- and sports-obsessed, materialist consumers who go into interest-generating debt buying stuff rather than spending Sundays in pious contemplation (Paul 2010b). Digital social media are detaching masses of people, especially youth, from the social clubs, including religious ones that try to pressure individuals and populations to be godly. The increasingly aggressive advocacy of explicit atheist opinion is not hurting matters.

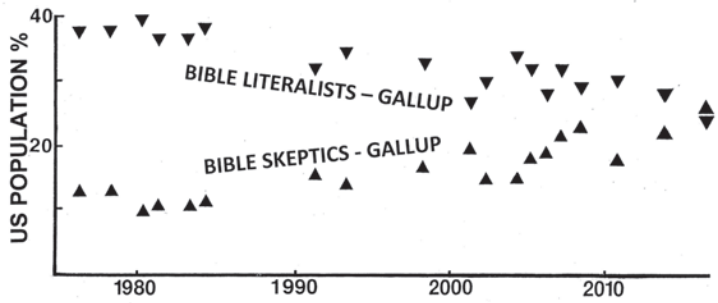
The churches—often riven by scandals and lacking the budgets to compete with corporate advertising—are proving unable to cope with these overwhelming forces of modernity. Without deliberately trying to do so, they are exploiting the fact that human brains are not nearly as interested in matters religious as they are in things material, so religion always rapidly implodes in developed democracies and much of the rest of the world.

Indeed, religion is sufficiently weak that it is not always well developed in underdeveloped peoples, as noted earlier. And unlike the human fundamentals of language, materialism, and sex, societies can do fine without the majority succumbing to religious thinking. For religion to thrive requires a combination of seriously suboptimal socioeconomics and substantial organized theopropoganda. The latter includes familial pressure to retain the family faith. However, with rapidly increasing numbers of irreligious parents, many youth are not being sufficiently contaminated by the magical supernaturalism of adults to share the urge to keep said faith; instead they are prone to be more rationally nontheistic.

The data are definitive. There is not a powerful "god engine" inside human minds—juvenile or adult—that is driving the masses to be pious. The magical thinking of juveniles may play some role or may not—we need better information on kids in atheistic democracies to sort that out. Are Danish tykes as supernaturalistic in their thinking as American children and then become more rational or do the former start out as skeptics from early on because of what they learn from irreligious parents?

It follows that religion is not the nearly inevitable result of how the brain works that has to be intellectually beaten out of childishly gullible adults to convince them via hard, science-based thought to become nonreligious. Theism is an optional opinion that often but not always is adopted by mass majorities when their life circumstances are sufficiently dysfunctional and when enough people in leadership positions

Rising Biblical Skepticism at the Expense of Literalism




**The premise that almost all humans are inherently religious stems to a great extent from the thesis that children are highly gullible for assorted reasons, including overactive pattern recognition.**

are exploiting such situations to establish religious power structures. It follows, then, that the discretionary opinion that is theism is easily, inevitably, and usually casually cast off when the life circumstances of the majority are sufficiently pleasant enough for most to no longer feel the need to go to the considerable trouble to petition powers of dubious reality.

The rise of nontheism is at the increasing expense of an increasingly frantic American religious Right (Dickerson 2013), including creationism. Gallup has been measuring a steady and strong decline in biblical literalism, which used to be about four in ten when Reagan was president, while biblical skepticism has persistently risen from one in ten. Both biblical literalism and biblical skepticism are now about one in four. While those who favor evolutionary science fret with considerable good reason over Ken Ham's Ark Park, which is not drawing quite the megacrowds he promised, the newest 2017 Gallup poll (Gallup 2017a; Gallup 2017b)—that Davidson et al. do not attend to because they continued to cite an obsolete 2014 Gallup compilation that was the latest available for the original *GSA Today* version of their article (the later SI edition should have been updated in view of the new data)—titled "In U.S., Belief in Creationist View of Humans at New Low," found that support for humans being created by God in the past few thousand years has, after slipping over the past ten years, dropped to the upper thirties. Even more important, those who agree with godless evolution have progressively doubled since the turn of the century to one in five. The 2013 Harris survey subtitled "Belief in Darwin's Theory of Evolution Rises" that Davidson et al. missed found that the support for such rose from 42 to 47 percent in a decade. According to a shorter term, more irregular Pew (2015b) sampling, those who think humans evolved in a natural manner rose from 32 to 35 percent in five years. So we have scientific evolution gaining 5 percent of total national opinion each decade.

As for who actually believes what, the oft-cited Gallup result that a very large minority of Americans think humans date back no more than ten millennia does not mean that all said citizens think the planet is that young. It is very probable that many who answer yes to people being that recent are fine with Earth being many millions of years old. With about a quarter claiming to be biblical literalists, and presuming that figure is theoinflated by the polling biases noted above, this suggests that a fifth or less are young-Earth creationists. The number who buy into the entire fundamentalist creationist line regarding the flood, the ark, dinosaurs as historical dragons, etc., is likely to be less than that. That about a quarter to a third of Americans are at least marginal atheists means that at least that many accept entirely naturalistic evolution, but so do a significant number of theists. At the same time, the Harris results indicating even higher support for the Darwinian theory may be somewhat inflated because some respondents did not realize it excludes the involvement of a creator. Therefore, perhaps a third to four tenths are evolutionists, as indicated by the Pew results. The rest of the population is some form of more moderate creationist, including those who accept intelligent design, mixed with those who might believe that humans were created by God in the past few thousand years but think that believing such humans rode dinosaurs that went extinct millions of years before is absurd nonsense.

The reason that bioevolution is quickly becoming more popular in the United States is obvious enough: atheists are automatically not creationists, and with the nontheist cohort soaring so rapidly, it is inevitable that pro-evolution opinion will be pulled up behind it. Irreligion is rising faster than support for bioevolution because many who convert from theism to atheism were already pro-evolution before making the switch to rationality. Only if acceptance of evolution was climbing more rapidly than atheism could the former be attributed mainly to theists becoming evolutionists while remaining theists. Another factor, ironically enough, may be the hardline creationists themselves. The leading fundamentalist of the late 1900s, Duane Gish of the then-predominant Institute for Creation Research, was an avuncular, grandfatherly, middle-of-the-country American able to come across as a man of faith who merely wanted his views on human origins presented to public school students. Ken Ham is a somewhat odd-appearing and odd-sounding Australian who through the aggressive propaganda campaign of his Answers in Genesis has done more than anyone to explain that biblical literalists really are sufficiently delusional to think humans lived with dinosaurs that were killed off by armored knights after departing an Ark. Not that the Discovery Institute's less deeply bizarre intelligent design movement exemplified by Phillip Johnson's Wedge Strategy using Michael Behe's theory of irreducible complexity to make creationism acceptable in academe and then the public at large has been able to stem much less reverse the pro-evolution trend. That the biotech industry has worked to keep such pseudoscience from contaminating the education system has something to do with that.

**The reason we don't allow kids to run societies is because they are too immature to do so. The reason we have mentally competent adults to run societies is because for all our failings most of us are not *that* gullible.**

Therefore, the substantial decrease in the popularity of creationism to the benefit of modern science is a rare—but somewhat underappreciated—success of the proscience skeptical community. Levels of belief in other forms of pseudoscience are apparently fairly static. It's good news that should be celebrated rather than ignored in the pages of SI. Progress is sufficient that the National Center for Science Education

and the American Association for the Advancement of Science have somewhat downplayed their anti-creationist efforts of late in favor of increasing outreach concerning climate change denial. That does not, however, mean that the need to better educate the public, especially students, about the scientific reality of bioevolution as argued by Davidson et al. has ceased. America remains the most pro-creationist Western nation. This is in turn largely a function of the country being the most religious in the West. But the pro-evolution effort is not, as Davidson et al. portrayed, in a state of crisis, with creationism remaining at least as popular as it has long been and with their project needing to at long last begin to effectively address and defeat a well-entrenched pseudoscience. Instead, the pro-evolution effort is a means of trying to accelerate an already winning trend. Whether attempting to boost the popularity of evolution among theists is effective has not been scientifically confirmed and is open to question considering how the growth of atheism can entirely explain the improving situation. But in addition to the ethical necessity, the only way to speed up acceptance of evolution beyond the current rate of 5 percent of the total population per decade is by increasing the support of the science by those theists who do not go atheist. Increasing outright conversion to atheism over its already demographically steep upslope is probably not practical.

**The churches of the developed democracies have largely emptied out, and the great majority of those losing their Christianity are not turning to alternative spiritualities.**

Also of concern is the current political resurgence of the religious Right that promises to increase governmental validation of creationist outreach via sympathetic court decisions made by creationism-tolerant judges appointed by theoconservative sympathetic officeholders. The most important reason that the conservative religious minority has so much power in the United States is a major and chronic political failure of the more rational majority, specifically a failure to vote at the same per capita rate as the religious Right. That can be largely solved by secular, proscience voters consistently turning up at the polls, as is the duty and responsibility of full citizens in a democracy.

One reason I wrote this piece is it is of course vital for the skeptical community to always be as up to date as possible. Yet I am observing a chronic failure among many skeptics and evolutionists to be familiar with the latest data. In this case, the ignorance of the Harris results on nonreligion, atheism, and evolution are especially vexing. Far from the state of the evolution versus creationism popularity contest being static in America, science is winning this one. The creationism problem can be expected to further recede as the forces of modernity continue to boost atheist opinion at the expense of theism, but there is a *long* way to go to victory. ■

## References


Barber, N. 2011. A cross-national test of the uncertainty hypothesis of religious belief. *Cross-Cultural Research* 45: 318–333.

Bruce, S. 2011. *Secularization: In Defense of an Unfashionable Theory*. Oxford: Oxford University Press.

Darwin's Theory Rises. Available online at http://www.harrisinteractive.com/NewsRoom/HarrisPolls/tabid/447/ctl/ReadCustom%20Default/mid/1508/ArticleId/1353/Default.aspx.

Dickerson, J. 2013. *The Great Evangelical Recession: The Six Factors That Will Crash the American Church…. and How to Prepare*. Ada: Baker Books.

Gallup. 2017a. In US, Belief in Creationist View of Humans at New Low. Available online at http://news.gallup.com/poll/210956/belief-creationist-view-humans-new-low.aspx.

———. 2017b. Record Few Americans Believe Bible Is Literal Word of God. Available online at http://news.gallup.com/poll/210704/record-few-americans-believe-bible-literal-word-god.aspx.

Gervais, W., and M. Najle. 2018. How many atheists are there? *Social Psychological and Personality Science* 9: 3–10

Harris. 2013. Americans' Belief in God, Miracles and Heaven Declines: Belief in

Norris, P., and R. Inglehart. 2004. *Sacred and Secular*. Cambridge: Cambridge University Press.

Paul, G. 2009. The chronic dependence of popular religiosity upon dysfunctional psychosociological conditions. *Evolutionary Psychology* 7: 398–441. Available online at www.epjournal.net/filestore/EP07398441_c.pdf.

———. 2010a. Religiosity tied to socioeconomic conditions. *Science* 327: 642.

———. 2010b. The evolution of popular religiosity and secularism: How 1st world statistics reveal why religion exists, why it has been popular, and why the most successful democracies are the most secular. In P. Zuckerman (ed.), *Atheism and Secularity*. Santa Barbara: Praeger, 49–209.

———. 2012. Why religion is unable to minimize lethal and nonlethal societal dysfunction within and between nations. In T. Shackelford and V. Weekes (eds.), *The Oxford Handbook on Evolutionary Perspectives on Violence, Homicide, and War*. Oxford: Oxford University Press, 435–470.

Peoples, H., P. Duda, and F. Marlowe. 2016. Hunter-gatherers and the origins of religion. *Human Nature* 27: 261–282.

Pew. 2010. Assessing the Cell Phone Challenge. Available online at http://www.pewresearch.org/2010/05/20/assessing-the-cell-phone-challenge.

———. 2014. Millennials in Adulthood. Available online at http://www.pewsocialtrends.org/2014/03/07/millennials-in-adulthood.

———. 2015a. America's Changing Religious Landscapes. Available online at http://www.pewforum.org/2015/05/12/americas-changing-religious-landscape.

———. 2015b. Evolution and Perceptions of Scientific Consensus. Available online at http://www.pewinternet.org/2015/07/01/chapter-4-evolution-and-perceptions-of-scientific-consensus.

RedC. 2012. Global Index of Religion and Atheism. Available online at www.wingia.com/web/files/news/14/file.14.pdf.

Rees, T. 2009. Is personal insecurity a cause of cross-national differences in the intensity of religious belief? *Journal of Religion and Society*11.

Zuckerman, P. 2008. *A Society without God: What the Least Religious Nations Can Tell Us about Contentment*. New York: New York University Press.

Gregory S. Paul is an independent researcher, analyst, and author. His latest book is *The Princeton Guide to Dinosaurs* (Princeton University Press 2010).

# It Is Not the God Engine That Sputters ...

## A Response to Gregory Paul

JAMES E. ALCOCK

I am puzzled by the tone of Gregory Paul's criticism of my article "The God Engine." While respectful and constructive criticism is always welcome, his scornful and dismissive condemnation is both unwarranted and unhelpful. Enough said.

I am also puzzled by his misunderstanding of my article. He has set up a strawman based both on his misinterpretation of what I have written and his apparent unfamiliarity with the careful and extensive body of empirical research that underlies it. (That research is discussed in greater depth in the book chapter from which my article is derived, and extensive references to the research literature are provided.)

I am also disturbed by his obvious misunderstanding of the limitations of the data that he adduces and his mistaken notion that they can be used to "scientifically" test theories about the acquisition of supernatural beliefs in childhood.

And, finally, I am disappointed that he has ignored the opportunity to make common cause. His "attack mode" stance appears to have blinded him to the fact that there is no contradiction between the demographic data he presents and what I have written about how normal cognitive developmental processes render children prone to supernatural beliefs.

*The strawman*: Paul misunderstands or misrepresents what I have written when he accuses me of reflecting the "common belief that religion is highly popular and enduring because it is a natural consequence of the way brains work from childhood on up." First, as I pointed out in the article, "religion" has to be taught; children do not invent deities or Santa Claus or tooth fairies on their own. If a child is not taught about Lord Krishna or Jesus, he or she will never develop that specific religious belief. However, because of the normal course of cognitive development, supernatural beliefs of one form or another come automatically to children, and they are very receptive to religious beliefs taught by trusted adults. Paul actually seems to agree with me on this point when he states that "children are highly gullible for assorted reasons including overactive pattern recognition that leads to unsubstantiated but often ardent belief in undetectable, magical things such as deities" and when he writes that "Another problem with the hypothesis that mass religion stems from children being automatically prone to magical and supernatural thinking is that they are taught such notions by adults, so it is more likely that kids are being contaminated by grownups than the reverse." But he then goes on to accuse me of "the assumption that adults are highly prone to retaining juvenile gullibility, which is exaggerated to the point of an unsubstantiated mythology." He stuffs more chaff into his strawman when he erroneously attributes to me the suggestion that our brains are "genetically preprogrammed" to be religious, that "almost all humans are inherently religious … ," and that theism of some form or another is "truly universal to human brains … ."

**Gregory Paul has set up a strawman based both on his misinterpretation of what I have written and his apparent unfamiliarity with the careful and extensive body of empirical research that underlies it.**

I did not suggest such things. As do beliefs in general, supernatural beliefs, including theistic ones, thrive or wither depending on their exposure to logic, their seeming rein-

forcement through experience, and whether they are stimulated or discouraged within the individual's important social groups. And when children are encouraged as they grow older to submit supernatural beliefs to logic, as they do with Santa Claus (even though some children struggle at first if informed by parents that there is no Santa), then they are likely to abandon specific theistic beliefs as well. On the other hand, when children are taught not to question and not to apply logic to their religious beliefs, challenging them becomes difficult, and it is often easier to "go with the flow" when part of a community that endorses such beliefs.

**Paul's "attack mode" stance appears to have blinded him to the fact that there is no contradiction between the demographic data he presents and what I have written.**

A more important concern about Paul's comments is his apparent *misunderstanding of the limits of survey data*. When he suggests that one can understand how religious beliefs originate by looking at surveys of professed belief and attendance at institutionalized religious services in adulthood, he is sadly in error. Such data can no more inform us about the origins of theism or atheism than can surveys of adult literacy rates help us understand the developmental processes involved in learning to read. When Paul goes on to write that "Alcock presents no statistical data relevant to the popularity of theism versus atheism either longitudinally over time, or laterally over nations, to confirm or deny his psychology-based hypothesis," this again demonstrates his failure to understand that such statistical data are unable in principle to confirm or deny such a hypothesis. (I should also add that it is not my "psychology-based hypothesis" that he is attacking but, as noted earlier, a widely shared conclusion based on a large body of careful psychological research carried out by a number of researchers.)

It is important to remember that self-reports about religious beliefs, records of attendance at religious gatherings, and so forth, are subject to a number of limitations in terms of the inferences they generate.

- First, such data are not direct measures of people's *beliefs* but are only measures of behavior (verbal and otherwise), and there is abundant evidence that behavior is often inconsistent with beliefs. For example, were one to conduct a belief survey in North Korea with regard to how wonderful a leader Kim Jong-un is, or to observe attendance at rallies organized to honor him, it would be most unwise to interpret a near-100 percent endorsement as evidence that all those people truly believe what they appear to profess. In this respect, Paul is inconsistent. On the one hand, he expresses complete confidence in survey data when they support his argument that atheism is increasing, but on the other, he challenges a similar kind of data concerning creationist beliefs, stating that "the oft cited Gallup result that a very large minority of Americans think humans date back no more than ten millennia does not mean that all said citizens think the planet is that young, because it is very probable that many who answer yes to people being recent are fine with the earth being many millions of years old." To be clear: I'm not challenging the survey data, only their overinterpretation.

- Second, one needs to consider with some care the questions each survey asks, for some will fail to gauge the full range of supernatural/theistic beliefs. For example, someone who does not believe in the god or gods that are worshipped in institutionalized religions is likely to respond in the affirmative when asked if he or she is an atheist but might simultaneously hold the belief that there is some sort of amorphous intelligence that has had a hand in setting up the universe.

- Yet, most important, Paul clearly misunderstands fundamental principles of "scientific testing" when he states that "Scientifically testing the problem is not at all hard to do. For theism of some form or another to be truly universal to human brains like language, materialism, and sex, it must be consistently the near-total opinion of all societies over all of time, with atheism being rare and hard to get to." (Please remember that this is a strawman he is attacking, as I never suggested that theism is "truly universal to human brains.") His argument that such information represents some sort of scientific testing is without merit, and the data he presents cannot by their very nature tell us anything about the *origins* of religious belief or atheism. He again confuses theistic belief as expressed in adults with the predilection toward such supernatural belief in childhood. Consider this example: It is probably true that it is the "near-total opinion" among all contemporary peoples that Earth is a globe and that it goes around the Sun. This is of course based on what people have been taught rather than direct experience or logic. However, no one would mistake such data for "scientific testing" of a claim that the heliocentric model of the solar system is "universal to human brains like language … ."

He compounds his misunderstanding about the limits of his data when he states that "The data are definitive. There is not a powerful 'god engine' inside human minds juvenile or adult that is driving

the masses to be pious." Not only are the data not "definitive," they tell us nothing about how or why people come to believe or disbelieve as they do.

Paul informs us that he has written his piece out of frustration with the skeptical community's ignorance of rates of atheism in various parts of the world. Fair enough. We must not throw out the baby with the bathwater, and it is essential to recognize the importance in its own right of the survey information he presents. I fully support his effort to bring this information forward, and while it is true that in my article, as Paul writes, "There is no mention by Alcock of the tremendous disparity in popular non/religiosity in developed democracies ... ," that omission is due to space considerations. I do indeed recognize the importance of such data and discuss them at length in the book chapter from which my article is condensed.

In closing, I encourage the reader to go beyond Paul's diatribe against "The God Engine" (for in reality there is no incompatibility between the data that he cites and what I have written) and instead to pay close attention to the data he presents, which reflect significant shifts in proportions of religious faith and atheism. Yet remember that while these data most likely reflect changes in the larger society in terms of a number of factors, including socioeconomic conditions, general anxiety, traditionalism versus modernism, individualism versus collectivism, the importance given to logic, and so forth, they do not allow for conclusions about causality. ■

James E. Alcock is professor of psychology at Glendon College, York University, Toronto.

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**Mom Guilt and the Glyphosate Saga**

In her "Woo Watch" column, Kavin Senapathy examines how anti-GMO and anti-glyphosate (an herbicide commercially sold as Roundup) activists have used "mom guilt" to scare and shame parents into supporting their causes. Senapathy writes, "being afraid of herbicide in our kids' cereal isn't empowering; it's a distraction at best."

# Screening for Prostate and Breast Cancer: It's More Complex Than You May Think

Cancer screening searches for cancer before its symptoms appear. Messages encouraging screening for prostate and breast cancer are not only filled with misleading statistics, they also do not discuss the most significant harm of screening: being diagnosed and treated needlessly.

FELIPE NOGUEIRA

"Pink October" and "Blue November" are campaigns to promote awareness for breast and prostate cancer, respectively. In Brazil, as well as in other countries, the population is encouraged to do tests such as the prostate-specific antigen (PSA) for prostate cancer and mammography for breast cancer.

The main idea is *screening*: to perform tests in healthy persons to detect and to treat diseases before their symptoms appear to increase the chances of cure and even to offer a less aggressive treatment. A good example of cancer screening is for cervical cancer, where incidence of the advanced cases decreased after the Papanicolaou test was introduced (Adegoke et al. 2012). However, studies that assess the efficacy of screening for prostate or breast cancer show that in reality things are more complicated than usually advertised by those campaigns.

In May 2018, the U.S. Preventive Services Task Force (USPSTF) reviewed studies of PSA screening for prostate cancer (Fenton et al. 2018). Only two randomized controlled trials were of sufficient quality to assess impact on mortality. One, called the PLCO,[1] did not show differences in mortality. The second trial, called ERSPC,[2] showed that screening reduced prostate cancer mortality in men aged fifty-five to sixty-nine. Even in that case, it's far from simple. In order to avoid one prostate cancer death and three cases of metastatic prostate cancer, 1,000 men aged fifty-five to sixty-nine have to be screened every four years during thirteen years. Of those, twenty-seven men received treatment—prostate surgery and/or radiation therapy. More important, the majority of those who were treated, twenty-four patients, received aggressive treatment with no benefits, only the harms caused by the treatment itself. Regardless of screening, five men died from prostate cancer. See Table 1 for complete estimates.

A careful analysis of cancer screening must consider harms of treatment. The USPSTF review found that of those who undergo complete prostate surgery, one in five men develop urinary incontinence and two in three experience impotence. More than half of those who receive radiation therapy develop impotence and one in six men develop bowel symptoms, including bowel urgency and fecal incontinence (Fenton et al. 2018).

The overall view that prostate cancer screening might cause more harm than good is far from new. A 2013 Cochrane meta-analysis (Ilic et al. 2013) of five studies showed no reduction in mortality, and in 2012 USPSTF recommended against screening regardless of age. At present, the USPSTF concludes the benefits and harms of screening for men aged fifty-five to sixty-nine are balanced, recommending an individualized decision after a careful consideration of potential benefits and harms. For men aged seventy and older, the USPSTF recommends against screening. See Figure 1 for USPSTF decision aid.

Regarding breast cancer, the evidence might look more favorable to screening with mammography, but again it's not as crystal clear as the campaign messages suggest. A 2018 *JAMA* article (Keating and Pace 2018) estimated that ten out of 10,000 women in their fifties screened annually with mammography during ten years would avoid breast cancer death. But 940 women would have unnecessary biopsies and forty-four would be treated needlessly with surgery, radiation, chemotherapy, or hormonal therapy. Despite screening, sixty-two women would still die from breast cancer. Since breast cancer treatment improved dramatically as trials were conducted, screening benefits might be even smaller today than those reported in trials (Keating and Pace 2018). To offer benefits while reducing the possible harms, the USPSTF recommends mammography *every two years* for women aged fifty to seventy-four and recommends *against* teaching breast self-examination.

This situation is not restricted to breast and prostate cancer. Between 1975 and 2009, the incidence of thyroid cancer in the United Stated tripled from 4.9 to 14.4 in 100,000. But the mortality rate remained constant: 0.56 in 100,000 (Esserman et al. 2014). A study in Finland detected thyroid cancers in autopsies of 36 percent of patients who had died

from other causes (Esserman et al. 2014).

Autopsy studies in prostates in patients who died from other causes also show a great disease reservoir (Sandhu and Adriole 2012). In autopsied men aged sixty to seventy-nine, the incidence of prostate cancer varied between 14 and 77 percent. Astonishingly, prostate cancer was found even in autopsied men in their twenties, with an incidence of 8–11 percent (Sandhu and Adriole 2012).

What these data are describing is *overdiagnosis* (Welch and Black 2010; Carter and Barrat 2017). Screening detects mainly nonlethal or harmless cases of cancers; if it weren't for screening we would die from other causes not even realizing that we also had cancer. Overdiagnosis is not a false-positive result, which is a positive test that subsequent evaluation shows no signs of cancer. In overdiagnosis, the lesion detected actually meets the diagnostic criteria for cancer but would not have caused symptoms (i.e., it would not have been diagnosed in the absence of screening)(Welch and Black 2010; Carter and Barrat 2017).

Overdiagnosis and its consequence are the main harms of screening. Since at the time of diagnosis it is impossible to differentiate harmless lesions from lethal ones, almost all cases are treated (Welch and Black 2010). Estimates suggest that between 20 percent and 60 percent (Fenton et al. 2018; Carter et al. 2015) of screen-detected prostate cancers were overdiagnosed. Of screen-detected breast cancers, the estimate of overdiagnosis from trials is 19 percent (Keating and Pace 2018), while an analysis of screening programs reported 52 percent (Jørgensen and Gøtzsche 2009). Then, a few might benefit from prostate and breast cancer screening, but more patients face harms of aggressive treatment they didn't even need in the first place.

One of the premises of screening is that cancer has a linear progression, which would always allow detection before it's lethal. But this premise is outdated. Cancers are heterogeneous, with different progression rates (Figure 2) (Carter and Barrat 2017). Screening is more likely to detect cancers that grow slowly or would have regressed. Critically, most lethal cancers, those that grow fast, are less likely to be detected by screening because they tend to cause symptoms between screening rounds (Carter and Barrat 2017).

While the messages encouraging screening tests rarely mention overdiagnosis, they often come with claims such as: "If it is early diagnosed, the chances of cure are 95%, but it's 20% if detected in advanced stage." However, when overdiagnosis exists, the rate of cured patients is biased, as the number of patients who survived cancer increases "automatically" because those patients with new harmless cases are now classified as "cured," even when screening offers no benefits. Ironically, the rise in cancer incidence and inflated rates of cure due to overdiagnosis might reinforce the efforts to do screening, leading to even more overdiagnosis[3] (Brodersen et al. 2018).

Another way the survival metric is biased relates to how many years the patient has lived after the diagnosis. Screening is effective only if it can detect diseases earlier. Consider, for instance, that without screening, patients are diagnosed due to symptoms at seventy years of age and die at seventy-five. Consider also that these patients would be diagnosed by screening at sixty-five and die due to cancer ten years later. With these descriptions, screening looks beneficial since whoever undergoes screening has a survival of ten years, and those who don't survive only five years after the diagnosis. In both cases, the patient died at the same time; screening only made the diagnosis earlier, without actually increasing the life expectancy. This is called the *lead time bias* (Raffle and Gray 2007).

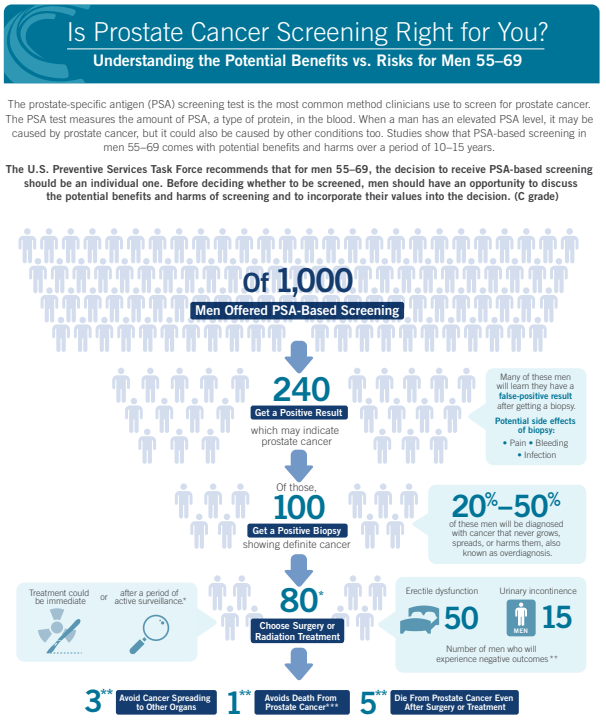

Is Prostate Cancer Screening Right for You?
Understanding the Potential Benefits vs. Risks for Men 55–69
The prostate-specific antigen (PSA) screening test is the most common method clinicians use to screen for prostate cancer. The PSA test measures the amount of PSA, a type of protein, in the blood. When a man has an elevated PSA level, it may be caused by prostate cancer, but it could also be caused by other conditions too. Studies show that PSA-based screening in men 55–69 comes with potential benefits and harms over a period of 10–15 years.
The U.S. Preventive Services Task Force recommends that for men 55–69, the decision to receive PSA-based screening should be an individual one. Before deciding whether to be screened, men should have an opportunity to discuss the potential benefits and harms of screening and to incorporate their values into the decision. (C grade)
Of 1,000
Men Offered PSA-Based Screening
240
Get a Positive Result
which may indicate prostate cancer
Many of these men will learn they have a false-positive result after getting a biopsy.
Potential side effects of biopsy:
• Pain • Bleeding • Infection
Of those,
100
Get a Positive Biopsy
showing definite cancer
20%–50%
of these men will be diagnosed with cancer that never grows, spreads, or harms them, also known as overdiagnosis.
Treatment could be immediate
or
after a period of active surveillance.*
80*
Choose Surgery or Radiation Treatment
Erectile dysfunction
50
Urinary incontinence
15
MEN
Number of men who will experience negative outcomes **
3** Avoid Cancer Spreading to Other Organs
1** Avoids Death From Prostate Cancer***
5** Die From Prostate Cancer Even After Surgery or Treatment

Figure 1. USPSTF illustration of benefits and harms of prostate cancer screening. Note the estimate of benefits is from the ERSPC trial, but harms are derived from three other treatment studies combined. Available at https://screeningforprostatecancer.org/get-the-facts/.

**Table 1: USPSTF Estimates of Benefits and Harms of Prostate Cancer Screening in the ERSPC Trial (Fenton et al. 2018).**

Of 1,000 Men Aged Fifty-Five to Sixty-Nine Screened Every Four Years (Biennially in Sweden) During a Period of Thirteen Years:

243 had positive screening tests;

220 had prostate biopsy;

2.9 were hospitalized for biopsy complications;

34.8 were diagnosed with prostate cancer;

23.9 were treated with no benefit;

6.9 developed impotence due to radical treatment;

1.8 developed urinary incontinence due to radical treatment;

2.9 avoided metastatic prostate cancer;

1.3 avoided death by prostate cancer;

4.9 died due to prostate cancer despite being screened.

Due to biases, survival statistics do not show the efficacy of screening. If screening works, the incidence of advanced cases must go down. After the introduction of breast and prostate cancer screenings, an increase was expected in the incidence of early cancers. That should be followed by, as the population ages, a compensatory decrease in advanced cancers, while overall incidence remains unchanged (Esserman et al. 2009). Note in Figure 3 that the incidence of early breast cancers increased significantly, while the incidence of regional cancers decreased very little and the rate of metastases to other parts of the body remained stable. Interestingly, although breast cancer mortality is falling, the decrease was larger in young women who were not invited to screening (Gøtzsche et al. 2012; Narod et al. 2015). In addition, breast cancer mortality decreased in a similar way over the world, but the start of screening differs between countries (Gøtzsche

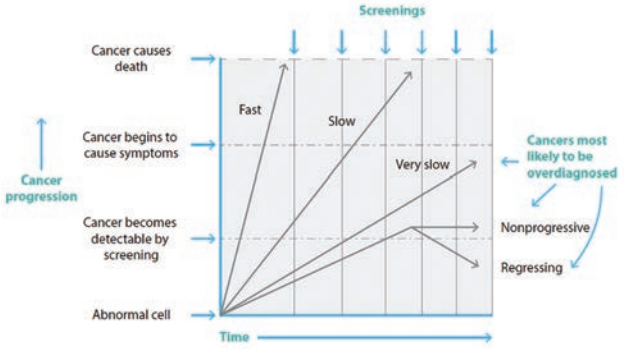



Figure 2. Heterogenity of cancer. Not all cancers have the same progression rate (Carter and Barrat 2017; adapted from Welch and Black 2010).

2015a). Similar observations could be made for prostate cancer. After screening, there was not a significant decrease in invasive cases as expected, and different rates of screening and treatment in different regions were unrelated to prostate cancer mortality (Esserman et al. 2009). These trend analyses, while not showing causality, indicate that screening leads to considerable overdiagnosis of early disease and that its impact on breast and prostate cancer mortality is small at best.

The best approach to measure screening efficacy is using randomized controlled trials, like PLCO and ERSPC. Trials compare a screened group with a control group, looking for a reduction in deaths caused by the cancer being screened

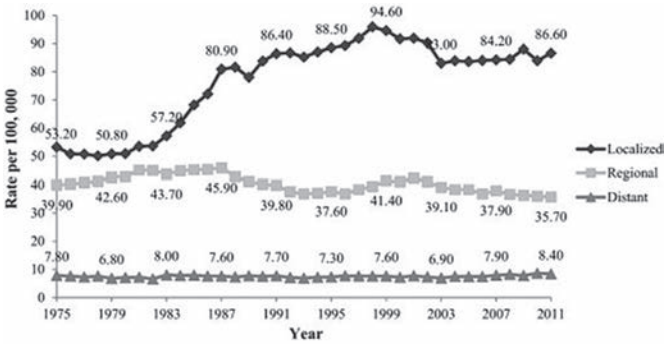



Figure 3. Incidence of different stages of breast cancer standardized by age in the United States White. SEER 9, 1975–2011. (Narod et al. 2015)

for—what's called cancer-specific mortality. It is, for instance, the reduction in breast cancer mortality that prompts the claim that mammography screening "saves lives." But as women *overdiagnosed* with breast cancer might receive radiotherapy, which increases mortality due to lung cancer (Gøtzsche 2015b), screening could cause more deaths than breast cancer deaths averted. Since deaths by treatment are usually classified as other causes, cancer-specific mortality is biased in favor of screening. This bias is avoided by using overall mortality. What might be shocking is that cancer screening trials do *not* show overall mortality reduction. As Vinay Prasad and colleagues wrote in the *BMJ* (Prasad et al. 2016), "cancer screening has never been shown to save lives."[4] Does screening increase deaths from other causes? We don't know—maybe it's just chance, since millions of people are required in a trial to look for a difference in overall mortality. Prasad and colleagues argued that those large trials are needed to know screening effects. In contrast, researcher Peter Gøtzsche thinks such trials are not an ethical thing to do, since a large number of people would have to be screened without knowing whether this will lengthen their lives, while it will make them less happy due to psychological distress caused by false-positive results and overdiagnosis (Gøtzsche 2015a). Due to small, if any, benefit in mortality but documented harms, Gøtzsche has stated that mammography screening would have been withdrawn from the market had it been a drug (Gøtzsche 2015b).

Other scientists, such as Laura Esserman, think that we should focus on ways to make screening better. For example, she and colleagues suggest not calling those indolent cases that are usually detected by screening "cancer" (Esserman et al. 2009). Since a cancer diagnosis is associated with a lethal disease that causes suffering in the minds of patients and physicians, renaming those as *indolent lesions* might reduce needless treatment. This was first proposed almost ten years ago, but as late as August 2018 other scientists are still asking for those changes (Nickel et al. 2018). Esserman has also proposed to move to a risk-based screening, which targets people at high risk of cancer. Testing whether risk-based screening can reduce mammography use without increasing advanced cancers is the objective of the Wisdom Study (Esserman et al. 2017).

Meanwhile, the public needs to be properly informed. The prostate and breast cancer awareness campaigns must be used to clearly tell the population the complexities regarding screening. This is very important; according to surveys, women overestimate the benefits of mammography screening by a factor of between ten and 200 (Wegwarth and Gigerenzer 2018). Also, as screening is often promoted as prevention, 68 percent of women in a survey wrongly believed that mammography reduces their chance of developing breast cancer (Domenighetti et al. 2003). As a perspective article in the *New England Journal of Medicine* (Biller-Andorno 2014) pointed out, "How can women make an informed decision if they overestimate the benefit of mammography so grossly?" This might be explained by doctors' failure to communicate screening risk: in a survey of 300 U.S. screening patients, 90 percent of them had not received information from their

doctors about the possible harms of screening (Esserman et al. 2009).

That's not the whole story. A 2017 systematic review showed that doctors usually overestimate screening and treatment benefits while they underestimate its harms (Hoffman and Del Mar 2017). A survey with primary care physicians in the United States suggests that doctors misunderstand screening statistics: 76 percent of doctor participants were misguided by the survival metric discussed earlier (Wegwarth et al. 2012). They wrongly thought patients diagnosed by screening with better five-year survival rates than patients diagnosed by symptoms means that the screening test saved lives. In an article Wegwarth and Gigerenzer (2018) asked, "Why is risk literacy so scarce in health care?" The authors discussed how the difficulty to understand risks and benefits in health likely lies with how statistical information is presented, from biased reports in medical journals to the use of relative risk and misleading statistics by the media. And research shows that decision aids help patients be more informed regarding screening decisions (Stacey et al. 2014). The researchers beautifully concluded: "A critical mass of informed citizens will not resolve all healthcare problems, but it can constitute a major triggering factor for better care" (Wegwarth and Gigerenzer 2018). ■

## Notes

1. PLCO: Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial

2. ERSPC: European Randomized Study of Screening for Prostate Cancer

3. This has been called the popularity paradox: "The greater the harm through overdiagnosis and overtreatment from screening, the more people there are who believe they owe their health, or even their life, to the programme" (Raffle and Gray 2007, 68).

4. Lung cancer screening with CT in heavy smokers in a 2011 trial reduced lung cancer and overall mortality. Even though this is a case of screening in a high-risk group, Prasad and colleagues considered it the best evidence for overall mortality reduction in a cancer screening trial. However, as discussed by the authors, a 2013 meta-analysis for the USPSTF has not shown overall mortality reduction (Prasad et al. 2016).

## Further Reading

*Overdiagnosed: Making People Sick in the Pursuit of Health* by H. Gilbert Welch, Lisa Schwartz, and Steve Woloshin (2012).

*Mammography Screening: Truth, Lies and Controversy* by Peter C. Gøtzsche (2012).

## References


Adegoke, O., S. Kulasingam, and B. Virnig. 2012. Cervical cancer trends in the United States: A 35-year population-based analysis. *Journal of Women's Health (Larchmt)* 21(10):1031–37. doi: 10.1089/jwh.2011.3385.

Biller-Andorno, N. 2014. Abolishing mammography screening programs? A view from the Swiss Medical Board. *New England Journal of Medicine* 370(21): 1965–1967.

Brodersen, J., B.S. Kramer, H. Macdonald, et al. 2018. Focusing on overdiagnosis as a driver of too much medicine. *BMJ* 362: k3494. doi: 10.1136/bmj.k3494.

Carter, J.L., R.J. Colett, and R.P. Harri. 2015. Quantifying and monitoring overdiagnosis in cancer screening: A systematic review of methods. *BMJ* 350: g7773. doi: 10.1136/bmj.g7773.

Carter, S.M., and A. Barratt. 2017. What is overdiagnosis and why should we take it seriously in cancer screening*? Public Health Research and Practice* 27(3): e2731722. doi: https://doi.org/1017061/phrp2731722.

Domenighetti, G., B. D'Avanzo, M. Egger, et al. 2003. Women's perception of the benefits of mammography screening: Population-based survey in four countries. *International Journal of Epidemiology* 32: 816–21.

Esserman, L.J., H. Anton-Culver, A. Borowsky, et al. 2017. The WISDOM Study: Breaking the deadlock in the breast cancer screening debate. *npj Breast Cancer* 3: 34. doi:10.1038/s41523-017-0035-5.

Esserman, L.J., I.M. Thompson, B. Reid, et al. 2014. Addressing overdiagnosis and overtreatment in cancer: A prescription for change. *The Lancet Oncology* 15: e234–e242. doi: 10.1016/S1470-2045(13)70598-9.

Esserman, L., Y. Shieh, and I. Thompson. 2009. Rethinking screening for breast cancer and prostate cancer. *JAMA* 302(15):1685–92. doi: 10.1001/jama.2009.1498.

Fenton, J.J., M.S. Weyrich, S. Durbin, et al. 2018. Prostate-specific antigen–based screening for prostate cancer: A systematic evidence review for the U.S. Preventive Services Task Force. *Agency for Healthcare Research and Quality*, Evidence Synthesis No. 154. AHRQ Publication No. 17-05229-EF-1.

Gøtzsche, P.C. 2015a. Commentary: Screening: A seductive paradigm that has generally failed us. *International Journal of Epidemiology* 244(1): 278–80. doi: 10.1093/ije/dyu267.

———. 2015b. Mammography screening is harmful and should be abandoned. *Journal of the Royal Society of Medicine* 108(9): 341–345. doi:10.1177/0141076815602452.

Gøtzsche, P.C., K.L. Jørgensen, P.H. Zahl, et al. 2012. Why mammography screening has not lived up to expectations from the randomised trials. *Cancer Causes Control* 23: 15–21 doi: 10.1007/s10552-011-9867-8.

Hoffman, T.C., and C. Del Mar. 2017. Clinicians' expectations of the benefits and harms of treatments, screening, and tests: A systematic review. *JAMA Internal Medicine* 177(3):407–419. doi: 10.1001/jamainternmed.2016.8254.

Ilic, D., M.M. Neuberger, M. Djulbegovic, et al. 2013. Screening for prostate cancer. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD004720. doi: 10.1002/14651858.CD004720.pub3.

Jørgensen, K.J., and P.C. Gøtzsche. 2009. Overdiagnosis in publicly organised mammography screening programmes: Systematic review of incidence trends. *BMJ* 339: b2587. doi: 10.1136/bmj.b2587.

Keating, N.L., and L.E. Pace. 2018. Breast cancer screening in 2018: Time for shared decision making. *JAMA*. doi:10.1001/jama.2018.3388.

Narod, S.A., J. Iqbal, and A.B. Miller. 2015. Why have breast cancer mortality rates declined? *Journal of Cancer Policy* 5: 8–17. Available online at https://doi.org/10.1016/j.jcpo.2015.03.002.

Nickel, B., R. Moynihan, A. Barratt, et al. 2018. Renaming low risk conditions labelled as cancer. *BMJ* 362: k3322 doi: 10.1136/bmj.k3322.

Prasad, V., J. Lenzer, and D.H. Newman. 2016. Why cancer screening has never been shown to "save lives"—and what we can do about it. *BMJ* 352: h6080 doi: 10.1136/bmj.h6080.

Raffle, A.E., and J.A.M. Gray. 2007. *Screening: Evidence and Practice*. Oxford University Press.

Sandhu, G.S., and G.L Adriole. 2012. Overdiagnosis of prostate cancer. *Journal of the National Cancer Institute Monographs* (45): 146–151.

Stacey, D., F. Légaré, K. Lewis, et al. 2014. Decision aids for people facing health treatment or screening decisions. *Cochrane Database of Systematic Reviews* CD001431.doi: 10.1002/14651858.CD001431.pub5.

Wegwarth, O., and G. Gigerenzer. 2018. The barrier to informed choice in cancer screening: Statistical illiteracy in physicians and patients. *Recent Results in Cancer Research* 210: 207–221. doi: 10.1007/978-3-319-64310-6_13.

Wegwarth, O., L.M. Schwartz, S. Woloshin, et al. 2012. Do physicians understand cancer screening statistics? A national survey of primary care physicians in the United States. *Annals of Internal Medicine* 156: 340–49. doi: 10.7326/0003-4819-156-5-201203060-00005.

Welch, H.G., and W.C. Black. 2010. Overdiagnosis in cancer. *Journal of the National Cancer Institute* 102: 605–613.

Felipe Nogueira received his PhD in medical science from Rio Janeiro State University. He has a master's degree in computer science. As a science writer, Felipe was a regular columnist for *Skeptical Briefs*—the newsletter of the Committee for Skeptical Inquiry. He has also made contributions to *Skeptic* magazine. His articles can be found at https://www.csicop.org/author/Felipe_nogueira and http://skepticismandscience.blogspot.com/.

# Better Than Dumbledore

HARRIET HALL

Have you ever wondered what it would be like if you could actually meet a character from fiction and chat with him over dinner? Who would you choose? One character I would enjoy meeting is Dumbledore, the kindly wizard who is the headmaster of Hogwarts in the Harry Potter books.

Here are some of his characteristics, culled from the books themselves and from descriptions by fans: tall and thin; white beard; aura of power; wears glasses; benevolent and wise; aura of serenity and composure; rarely displays intense emotions; eccentric and even slightly effeminate; sometimes wears flamboyant clothes; whimsical; uses humor to make people feel comfortable in his presence; has extraordinary powers, and his abilities as a wizard are combined with cunning, subtlety of mind, and understanding of human nature; never arrogant or pompous; deep capacity for love; immense brainpower, although it doesn't protect him from emotional mistakes; has a pet phoenix named Fawkes; carries a wand; a late disclosure by the author reveals that he is gay.

Fortunately, there is something far better than meeting Dumbledore in person: meeting someone who is very much like Dumbledore but better because he has the advantage of being real. I'm talking about James ("The Amazing") Randi.

Like Dumbledore, Randi is thin and has a long white beard. His stature is also noteworthy, although for shortness rather than tallness. He wears glasses, although he has been known to wear frames with no lenses in them to show people how readily they make false assumptions based on expectations. He too has an aura of power that can be seen in some of his iconic photos where he stares at the camera with hypnotic intensity. He is also benevolent and wise, maintains his composure, and is eccentric. Sometimes when traveling he wears a flamboyant wizard's cape and hat. His sense of humor is notorious; he will tell funny stories at the drop of a hat. In fact, he even laughs at *my* lame jokes and puns, which says a lot. Like Dumbledore, he makes everyone feel comfortable in his presence; at conferences he tries to meet everyone present, shake their hand, and make them feel welcome. He is genuinely friendly, looks you in the eye, and gives you the kind of full attention that makes you feel that he really cares about you, whether you are a VIP or a young child. He

James "The Amazing" Randi

is never arrogant or pompous. Like Dumbledore, he carries a stick—Dumbledore's is a wand; Randi's is a cane with a skull on the handle. Randi's is bigger, in case you want to read something into that. Like Dumbledore, Randi is gay. Like Dumbledore, his homosexuality was revealed late in the game; unlike Dumbledore, he had the courage and honesty to reveal it himself rather than waiting for someone else to reveal it after his death. He, too, has an animal associated with him, but instead of a mythical bird, his is a symbolic flying pig. Just as Dumbledore sincerely cares about his students at Hogwarts, Randi sincerely cares about the people who are harmed by trickery. I have seen him fighting tears as he described the disappointment of a child who left a faith healing session uncured.

Like Dumbledore, Randi clearly has immense brainpower. He won a MacArthur genius grant. With no formal education beyond high school, he educated himself about science to a point that he understands it better than many scientists. His background in magic gives him invaluable insights into the psychology of how people can be fooled and how scientists can go wrong and fool themselves. He is almost always the smartest person in the room and the hardest to fool.

And like Dumbledore, Randi can perform impressive feats of magic, although he makes it clear that he uses the methods of stage magicians rather than any supernatural powers. His magic doesn't even require a wand! One of his best tricks is the one where his hands are securely tied and yet he is immediately able to reach over the drape with a freed hand to point as he gives instructions to his assistants. It's not just the escape that impresses; it's the style, pacing, and humor of the whole consummate performance.

It has been my great privilege to know Randi and call him a friend. At first I was excited just to hear him speak. I was so proud when he began to recognize me and remember my name and even more proud when he asked me for a hug. I have shared a dinner table with him many times now and have had many opportunities for one-on-one conversations. I have been on three Amazing Adventure cruises with him and have fond memories of Randi on the beach in the Galápagos, on Mount Juneau in Alaska, and at the Mayan pyramids.

He is a world-class raconteur, and I never tire of his stories even when I've heard them before. Among my favorites are the ones about the matchbox trick that fooled the scientists, the story of Project Alpha where two young magicians convinced scientists they had psychic powers, the Carlos hoax in Australia, the stories about his tour with Alice Cooper, and his explanation of why PhDs are incapable of saying these two sentences: "I was wrong" and "I don't know."

Who could ever forget his demonstration of psychic surgery and his exposé of Peter Popoff on the *Tonight Show*? Who could forget the quip that followed his replication of Uri Geller's tricks: "If Uri Geller bends spoons with divine powers, then he's doing it the hard way"?

As a doctor, I particularly appreciate Randi's work in the areas of quackery and faith healing. His work on homeopathy is particularly noteworthy; for instance, his investigation of Jacques Benveniste's lab with the team from *Nature*, the failed replication of a homeopathy study during an unsuccessful attempt to win the million dollars on British TV, his lectures explaining how ridiculous homeopathy is, and his public demonstrations of "overdose" with homeopathic remedies. After his health crises with coronary bypass and intestinal cancer, he also spoke out in praise of science-based medicine, saying that it had saved his life and that chemotherapy was nowhere near as bad as advertised.

Randi has worked vigorously and incessantly to promote critical thinking and to expose charlatans. His work serves as an example to all skeptics. Through its blogs, forums, meetings, and other efforts, the James Randi Educational Foundation (JREF) reached people who might not otherwise have joined the skeptical community, especially some of the younger folks, women, and minorities. Thanks to the JREF, skeptics can no longer be stereotyped as grumpy old upper middle class heterosexual white men.

**Like Dumbledore, he carries a stick—Dumbledore's is a wand; Randi's is a cane with a skull on the handle.**

The very existence of Randi's Million Dollar Challenge was of immense use to skeptics. We could tell psychics and charlatans to put up or shut up. All we asked is that they simply demonstrate that they could do what they claimed, and they would get a million bucks. Sylvia Browne agreed on national TV to take the challenge but later changed her mind. One might ask why her psychic powers didn't predict that she would change her mind. (Of course, if I had a mind like hers, I'd want to change it too!)

It was with good reason that Randi was voted the most prominent skeptic of the twentieth century. He has accomplished so much! His special magic has changed the world for the better. He is a treasure. He has been one of the major inspirations for the skeptical work I do. I respect him. I admire him. I love him. He's *way* better than Dumbledore! ■

Harriet Hall, MD, is a contributing editor and columnist for Skeptical Inquirer.

# A Skeptical Guide through the Conspiracy Rabbit Hole

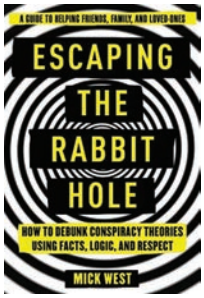
CELESTIA WARD

Mick West might just be the consummate gentleman debunker.

After devoting the past fifteen years to online conspiracy-fighting projects such as MorgellonsWatch.com, ContrailScience.com, and Metabunk.org, he has released a new book. It's easy to see conspiracy theorists as unreachable, unreasonable, and unredeemable. But West is here to help, and he offers this help on multiple levels. It can be self-help if the friend caught up in a rabbit hole is *you*; it can be help for loved ones, even if they act like enemies when certain topics come up; and it can be help for society at large. The harm these false beliefs cause is not limited to particular relationships or households—it spills into public discourse and legislation.

West sees the term *debunking* as noncontroversial in this instance, because when he shows people the error of chemtrails or flat-earth theory, he is not remaining impartial to investigate an unknown but rather introducing people to facts that have already been proven. The bunk has already been established as bunk; it's now an issue of *debunking* the mindset. A former game programmer, West admits it's a process comparable to debugging.

Readers seeking a trove of empirical data might be disappointed, as *Escaping the Rabbit Hole* is not packed with charts and graphs—with a few exceptions, such as a graph illustrating the usage of the term *conspiracy theory*, to debunk the idea that the CIA promoted the term *conspiracy theory* as a pejorative in a 1967 memo (… talk about *meta* bunk). West offers a tour of some of the academic thinking on conspiracy theorists, but he cautions that the psychology of conspiracists is not well understood. The few traits they are said to share are often overstated and understudied. The sixteen pages of endnotes are mostly links to online articles, conspiracy videos, and threads.




*Escaping the Rabbit Hole: How to Debunk Conspiracy Theories Using Facts, Logic, and Respect*. By Mick West. Skyhorse Publishing. 2018. 304 pp. Hardcover, $21.99; kindle, $13.19.

**It's easy to see conspiracy theorists as unreachable, unreasonable, and unredeemable. But West is here to help, and he offers this help on multiple levels.**

The book touts itself as "A Guide to Helping Friends, Family, and Loved Ones," and as promised, it takes on a personable tone as West teaches you how to be a consummate gentleman (or gentlewoman) debunker. It's a conversational book about how to have effective conversations. Through examples and testimonies, he shows us that it *is* possible to extract someone from a rabbit hole. There's a method to his respectful tone and empathy: it works. He summarizes the three critical elements of *maintaining an effective dialogue*, *supplying useful information*, and *giving it time*. Or, as he paraphrases himself: "Talk to them, show them stuff they missed, and don't rush."

Part one lays out some debunking techniques and familiarizes us with the term *conspiracy theory* and the spectrum of beliefs. Readers who have never been trapped in a rabbit hole themselves and might simply dismiss conspiracists as crazy or gullible (as many skeptics do) will benefit from the charitable description West offers, bringing us into the fold enough to understand the commonalities we have with conspiracy believers. Conspiracy theory belief, as West says, "is as American as apple pie, and like apple pie it comes in all kinds of varieties, and all kinds of normal people like to consume it."

Part two comprises in-depth looks at four particular types of conspiracy theories (chemtrails, 9/11 demolitions, false flags, and flat earth) as well as stories from people once taken in by those theories. Throughout the discussions, West provides resources and sensible approaches to dealing with these conspiracy theories, ones he is particularly experienced with, thanks to Metabunk. Being a capable debunker means becoming familiar with the conspiracies, and West saves us time by summarizing what believers subscribe to (includ-

ing variations, as no group is completely homogenous). Indeed, the fact that each believer is unique means that different approaches are needed.

In part three, his final two chapters discuss complications and the future of debunking. Turning someone away from a seductive, simplified view based on scientific misunderstanding will never be easy. It requires scientific communication on a very personal level, doing research, and gaining an understanding of fields that you might be unfamiliar with—and, even if you do the work, your friend might not be able to understand it. Or, if you succeed communicating the ideas, accepting a new version of reality might be complicated by family dynamics or personal conflict. We also have Russian trolls, bots, AI, and other technological surprises that will make debunking even harder.

Debunking conspiracy theories is a lot of work. But it's worthwhile if you are helping a loved one out of a mindset that can cause them harm. Mick West has shouldered a tremendous amount of the work himself, summarizing some conspiracy beliefs and demonstrable facts to refute those beliefs in this relatively short book (278 pages, plus a useful index). He offers both psychological and practical shortcuts—in one instance he directs us to a video of old books he's collected to debunk chemtrail theory. This simple video showing old-fashioned books has persuaded many who had rejected similar online images as fake.

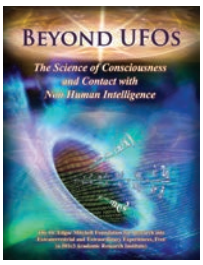
One hope that comes through in the personal stories is the notion of turning conspiracy theorists into conspiracy debunkers. Many conspiracists are already prone to asking questions; they just need guidance on how to vet information. West describes his own transition as a youth, swapping information via bulletin boards, and how his fascination with strange phenomena shifted from reading about the unexplained to, instead, finding explanations and sharing those with his friends. Other people he quotes made similar transitions, if a bit later in life, and describe how they enjoy keeping up with conspiracy theories nowadays simply so they can interject new knowledge back into their old communities.

With persistence—and of course facts, logic, and respect—we might just pull something unexpected out of a few rabbit holes: skeptics. ■

Celestia Ward is a longtime skeptic and artist based in Las Vegas and cohost of the podcast *Squaring the Strange.*

# What Are Contact 'Experiencers' Really Experiencing?

TED GOERTZEL




*Beyond UFOs: The Science of Consciousness and Contact with Non-Human Intelligence, Volume I.* Edited by Rey Hernandez, Jon Kilmo, and Rudy Schild. The Dr. Edgar Mitchell Foundation for Research into Extraterrestrial and Extraordinary Experiences. 2018. ISBN: 978-1721088652. 802 pp. Softcover, $29.95; Kindle, $19.95.

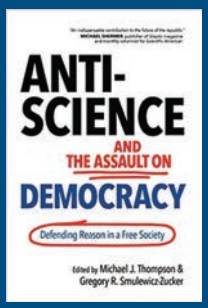
This book is touted as the first comprehensive worldwide scientific investigation of individuals who have reported contact experiences with nonhuman intelligences. It is widely promoted to a movement of "experiencers" who believe that their experiences are real. The authors include many qualified social scientists, including four retired academics with PhD degrees. They report the results of qualitative and quantitative surveys of 4,200 individuals in 110 countries conducted in four languages (English, Spanish, German, and Slovak). The book is long at 802 pages and often repetitive, but this has the great merit of allowing the writers to report the quantitative results in detail and include extensive excerpts from the qualitative interviews.

I was pleased to see that the study replicated the key finding of a much smaller survey I published in the Skeptical Inquirer in 1994, "Measuring the Prevalence of False Memories." In that article, based on a small population survey, I reported that people who believed they had been contacted or abducted by UFOs were also likely to have experienced other kinds of unusual experiences, such as being visited by a dead relative, seeing a witch or a devil in their bedroom, or seeing a ghost. I interpreted this as false memory syndrome.

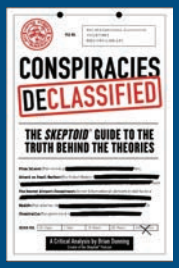
The authors of the current study also report that UFO "experiencers" report these kinds of unusual experiences.

# [NEW AND NOTABLE

*Listing does not preclude future review.*




**ANTI-SCIENCE AND THE ASSAULT ON DEMOCRACY: Defending Reason in a Free Society.** Michael J. Thompson and Gregory R. Smulewicz-Zucker, editors. Thirteen original essays by political scientists, hard scientists (e.g., Alan Sokal and Lee Smolin), philosophers of science (Barbara Forrest, Phillip Kitcher, Michael Ruse), and other scholars. They examine antiscience and argue that respect for science is essential for a healthy democracy. Divided into four sections: "Reforging the Link Between Science and Democracy"; "Science's Democratic Dimensions"; "Perverted Science, Disfigured Democracy"; and "The Revenge of Anti-Science." The antiscience the editors and authors consider is not just about global warming, vaccines, creationism, GMOs, and other specific fields but also about science itself; they condemn postmodernist relativisms' damaging campaign alleging that science is "elitist" or a mask for social power and influence. The "collective thesis" of the essays, in the editors' words, is that "democracy is withering due in no small part to our culture's drifting away from the scientific mindset and the erosion of reason that results from it." Prometheus Books, 2018, 304 pp., $26.




**CONSPIRACIES DECLASSIFIED: The Skeptoid Guide to the Truth Behind the Theories.** Brian Dunning. Veteran skeptic Brian Dunning, host of *Skeptoid Media*, examines a host of conspiracy theories. *Conspiracies Declassified* is divided into eight parts, including "Those Who Run the World" (the Bilderbergers and Reptoids, for example); "Government Oppression" (chemtrails, FEMA prison camps, and vaccine conspiracies); "Space Conspiracy Theories" (Area 51, the Roswell crash, the moon landing hoax, etc.); "Suspicious Deaths" (of Princess Diana, John F. Kennedy, and Elvis Presley, for example); and "Suppressed Science" (including flat-earthers, free energy claims, and Big Pharma). Some of these topics are, of course, well-trod. But Dunning has included a variety of lesser-known conspiracies as well, and even longtime skeptics are sure to find fascinating (and often funny) information on the "Black Knight satellite," the Pearl Harbor attack, and the theory that Finland is fictional. Given the often-nebulous nature of conspiracies, Dunning wisely describes two criteria for inclusion: the conspiracy must be both falsifiable and identified by the conspiracists at the time, instead of retroactively. The last section covers conspiracy theories that turned out to be true—or at least have a significant element of truth to them. After all, conspiracies absolutely do exist. A fuller discussion of how readers can distinguish real from imagined conspiracies might have been helpful, but *Conspiracies Declassified* is not meant to be an exhaustive or definitive guide to all conspiracies. After all, many of them (such as the Kennedy assassination and the 9/11 attacks) have spawned reams of books in their own right. It is instead an accessible overview of referenced, skeptical replies to conspiracies and is (along with Mick West's new book *Escaping the Rabbit Hole*) a useful resource for skeptics and layfolk alike. Adams Media, 2018, 256 pp., $15.99.

They find that these experiences are much more common than experiences with UFOs, and they are skeptical of the whole UFO narrative (thus the title *Beyond UFOs*). They differ with me and with most skeptics in believing that these experiences are probably real. They suspect they are real because so many experiencers experience similar things and because they report them with such certainty. They ask why we accept eyewitness testimony in courts of law but not in the case of these reports. And they encourage experiencers to turn to the parapsychology researchers for further evidence.

**To their credit, the authors do not claim to have "proved" the reality of these experiences. They concede that they are unprovable with any known methods.**

To their credit, the authors do not claim to have "proved" the reality of these experiences. They concede that they are unprovable with any known methods. They speculate that nonhuman intelligences must be using methods of communication that are beyond our understanding and express the hope that "perhaps the depth and detail, and quantity and even purposeful repetition, of similar descriptions contained in this qualitative study's results will make a case that could only be made in this way that there truly is something substantive and very real going on about the experiences being reported here."

The most interesting and valuable parts of this book are those that report on the qualitative interviews in detail, with a great many quotes from respondents. But there is nothing in them that suggests input from any extraterrestrial source. The messages of the nonhuman intelligences include commonplaces such as advocacy of "love, oneness and unity" and the assertion that "the human race of earth is overpopulated." The experiencers report that "we have many lives but one existence" and that "I was surprised by the connection to Zen, Tao experience" and that "I now understand myself to be part of universal consciousness that is linked not only to every being in the universe but also to the entire universe itself."

The messages are positive and life affirming, and the experiencers feel comforted and inspired by them. They are also entirely banal, recycling well-trod religious and philosophical ideas. One reports that "the only thing that happened to me spiritually was that I gained a

higher appreciation for a universal God. If anything, my belief in a higher power was increased, not decreased. I am less afraid of death, I feel more comfortable being alone versus socializing." The reported experience is very similar to religious conversion, and the experiencers believe their lives to have been enriched in much the same ways that other religious converts report.

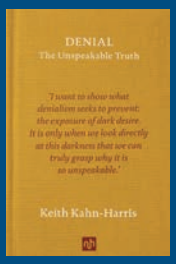
The researchers also asked about scientific ideas communicated by the nonhuman intelligences. The reported scientific ideas were perhaps even more banal than the spiritual insights. Experiencers reported that "there is no such thing as time. It is not part of space, as in space/time, but is just a measure of motion relative to particle activity," "the physical part of your body is a frozen consciousness," "each dimension has 12 dimensions attached to it which makes 144 altogether," and "as we evolve over the span of many lives our vibrational frequency increases and we gradually move up the ladder." One experiencer was advised to "educate myself on superstring theory and Freudian psychology."

One experiencer asked the nonhuman intelligence to "tell me something that I don't already know, something totally new so I can verify that you are not me." He or she reports that "the answer I received shook me to the core. The alleged ET communicated in a mocking tone: 'If you believe in "universal consciousness," as you claim you do, what difference does it make whether it is your consciousness or ours!'"

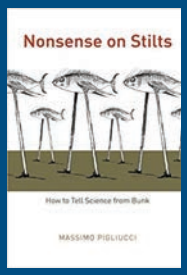
**The most interesting and valuable parts of this book are those that report on the qualitative interviews in detail, with a great many quotes from respondents. But there is nothing in them that suggests input from any extraterrestrial source.**

There is nothing in these reports to suggest that the contactees are experiencing anything other than their own thoughts. The scientific or philosophical ideas add nothing to those disciplines; the religious ideas may be of value if they are taken on faith like other religious thoughts. ■

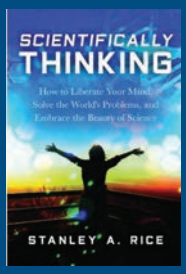
Ted Goertzel, PhD, is professor emeritus of sociology at Rutgers University in Camden, New Jersey. His article "The Conspiracy Meme" was the cover article for the January/February 2011 Skeptical Inquirer.




**DENIAL: The Unspeakable Truth.** Keith Kahn-Harris. The author, a writer and sociologist in the U.K., thoughtfully examines denial and denialism in our "post-fact," "fake news" era (although he notes that their efforts are the results of decades of work to create suspicion about scholarship and science). It's not a book debunking denial but an attempt to understand it, to recognize its allure, and even to give deniers an alternative perspective. It's a fresh, if a bit unusual, take on the subject. Chapters include "The Audacity of Denialism," "Doing Denialism," "The Denier's Alternative," "The Post-Denialist Age," and "An Alternative." Notting Hill Editions, 2018, 188, pp., $18.95.




**NONSENSE ON STILTS: How to Tell Science from Bunk.** Second Edition. Massimo Pigliucci. In this fully revised and welcome second edition, biologist-turned-philosopher Massimo Pigliucci (a CSI fellow and past columnist for Skeptical Inquirer) explores how to separate fact from fantasy as he examines the nature of science, the borderlands of fringe science, and—borrowing philosopher Jeremy Bentham's phrase—the nonsense on stilts. For this new edition, Pigliucci has dropped chapters on global warming and intelligent design and added two new chapters, one on scientism and another, "Frustrating Conversations," relating how difficult it is to have conversations with friends and relatives who may be intelligent and well-read but aren't able to discriminate between credible and questionable sources of information. When the first edition was published in 2010, we called Pigliucci's approach "thoughtful and intellectual" and "original and fruitful," said "the writing is clear, the case studies abundant," and concluded that the book was a "refreshingly original excursion over the unmarked territory separating science from pseudoscience and nonscience." University of Chicago Press, 2018, 317 pp., $22.50.

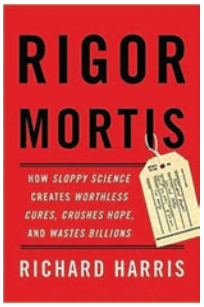



**SCIENTIFICALLY THINKING: How to Liberate Your Mind, Solve the World's Problems, and Embrace the Beauty of Science.** Stanley A. Rice. In a world flooded with more "information" than we can ever absorb or comprehend and with our brains that even when working correctly create biases and illusions, we need a new way of thinking, says author Rice, a biologist (author of *Life of Earth* and *The Encyclopedia of Evolution*). Luckily for us, that way already exists: the scientific method. But he quickly emphasizes that we don't all have to become scientists—anyone can do it, and everyone should. He shows us how. He points out that every child begins with that ability. He also emphasizes that scientific thinking is in essence an instinctual ability that not only helps us but can lead us to beauty and joy. In four sections: "The Adventure of Science," "Legacy of an Ape's Brain," "Big Ideas," and "The Role of Science in the World." Prometheus Books, 2018, 288 pp., $25.

—Kendrick Frazier and Benjamin Radford

# Say It Isn't So

KENNETH R. FOSTER




*Rigor Mortis: How Sloppy Science Creates Worthless Cures, Crushes Hope, and Wastes Billions.* By Richard Harris. New York: Basic Books. 2017. ISBN: 0465097901. 288 pp. Hardcover, $28.

Richard Harris, a distinguished science journalist with National Public Radio, presents a deeply skeptical view of science in this journalistic but accurate depiction of the "other side" of science.

The story opens: "Each year about a million biomedical studies are published in the scientific literature. And many of them are simply wrong." Harris describes the experience of C. Glenn Begley, a scientist at biotech company Amgen, who discovered that much of the academic research his company relied on could not be replicated. In 2012, Begley published a highly cited commentary in *Nature* calling for better preclinical research. Other scientists began publishing similar results. In 2015, Leonard Freedman (of the Global Biological Standards Institute in Washington, D.C.) summarized estimates by other scientists that between 51 and 89 percent of studies were in some way unreproducible, at an estimated cost to the U.S. taxpayer and industry of about $28 billion per year. Harris tells of other scientists who came to similar conclusions.

Harris personalizes his story by recounting tragedies to patients in clinical trials of drugs that do not work as a result of, he suggests, poor decisions by drug companies based on unreliable preclinical science. He describes an unsuccessful $20 million clinical trial of a drug to combat amyotrophic lateral sclerosis (ALS): "The results: fail, fail, fail, fail, fail, fail, fail. Science administrators had assumed that the academic scientists had all done the legwork carefully. They had not."

Other chapters recount a variety of loosely related issues to the reliability of biomedical research. These include the unreliability of animal and *in vitro* (cellular) studies for drug development, use of genetic markers from tumors to help choose therapy for patients, and contamination of cell lines—all real problems that are discussed in the scientific literature. Harris personalizes these issues with accounts of victims of bad science and honest scientists who are trying to set matters straight.

In a long section that is generally accurate but highly oversimplified, Harris discusses the root cause of much false discovery in science: inappropriate use of null hypothesis significance testing and the criterion of $p<0.05$ to establish "statistical significance" as the threshold for publication of results. Statisticians have been lecturing scientists for decades about the fallacy of this approach, but it remains routine practice for many scientists. This issue turns on what, to most readers, will be arcane issues in statistics. From my experience as a journal editor, the issues are not widely understood even by scientists themselves, and as a journal editor I constantly struggle with manuscripts that draw invalid conclusions from weak data using inappropriate statistical methods.

**Scientists have estimated that between 51 and 89 percent of studies were in some way unreproducible, at an estimated cost to the U.S. taxpayer and industry of about $28 billion per year.**

Harris suggests some solutions to the problem. He praises scientists who work endlessly to get experiments right by identifying unanticipated sources of variability in their experiments and work to improve the standards of reporting of science. Both funding agencies, including the U.S. National Institutes of Health (NIH), and scientific publishers have developed programs to encourage authors to clean up their acts, such as identifying sources of the cell lines and other research materials they used—which astonishingly many authors fail to report in their papers. Reviewers of NIH grant applications (myself included) are now asked to assess the rigor of proposed studies. But scientists are often looking for small effects in complex systems, and the results of an experiment can depend on tiny details of experimental technique. There is only so much a reviewer can do.

Is the problem really as bad as Harris lets on? Yes and no. The reliability of science depends a lot on where it is done and for what purposes. Pharmaceutical companies, faced with rapidly escalating costs once a potential drug has passed the preclinical stage, have much to gain by careful quality control even in preclinical work. Moreover, drug development and testing is subject to stringent controls of good laboratory practice that, while imposing burdensome pa-

perwork requirements, at least keeps error rates down as well. While poor quality preclinical work might lead to development of ineffective drugs, there are many reasons only one out of ten experimental drugs that enter Phase I clinical trials eventually receives FDA approval (see, for example, https://www.amplion.com/inthenews/report-suggests-drug-approval-rate-now-just-1-in-10). There are simply too many variables at play when scaling research from animal studies to clinical trials—complexities that Harris alludes to but that are difficult to control or predict. Drug companies would dearly love to increase their success rate, but improving the reliability of preclinical research is only part of the solution.

**Harris personalizes these issues with accounts of victims of bad science and honest scientists who are trying to set matters straight.**

The situation in academic labs is often different. Scientists want to come up with new ideas, do exciting research, publish papers in high-status journals, give featured lectures at conferences, and write grant applications that will excite reviewers and maintain the flow of funding. Postdocs must publish during their relatively short appointments if they hope to have a research career. Scientists need to get product (papers) out the door. As Harris correctly points out, the hypercompetitive atmosphere of most academic science encourages scientists to cut corners. In the September 12, 2018, issue of *Nature*, John Ioaniddis and colleagues reported that 9,000 scientists around the world each have published a paper on the average of once every five days in at least one recent year. Do they even have time to read their own papers?

Clearly the reliability of much published research is poor, and the problem is becoming much worse with the flood of new online journals, many lacking careful peer review. Here are two examples. A search on Google Scholar will reveal thousands of studies that propose methods to diagnose disease using data from online databases and machine learning software. How many of these diagnostic methods will prove successful in real-life medicine? Not many, I'd guess.

A second example is a research field of mine—biological effects of electromagnetic fields, including cell phone radiation. The literature is swamped with low-quality studies reporting biological effects of electromagnetic fields. Many of the studies appear simply to be one-shot experiments, reporting small effects in noisy data using inappropriate statistics, with study designs lacking such elementary precautions as use of concurrent sham controls. Health agencies generally give such papers little weight in their reviews of the literature, and they consistently find no clear evidence for health risks of electromagnetic fields within international exposure limits. For their part, people concerned about what they consider health risks of electromagnetic fields can cherry pick this diverse literature to support alarmist positions.

I invited Lorne Trottier, a nonscientist who has been active in the skeptics' community for many years, to comment further (see sidebar). ■

Kenneth R. Foster is a professor in the Department of Bioengineering at the University of Pennsylvania.

## From Our Archives

"Moving Science's Statistical Goalposts," Stuart Vyse, November /December 2017.
"Academies Report Urges Bolstered Efforts to Protect Integrity of Science," Kendrick Frazier, July/August 2017.
"A Scientist Pushes Psychology Journals toward Open Data," Thomasz Witkowski, July/August 2017.
"The Do's and Don'ts of Trusting Science," Faye Flam, July/August 2016.
"Commentary on John P.A. Ioannidis's 'Why Most Published Research Findings Are False,'" Ray Hyman, March/April 2006.

## We Need to Put the Reproducibility Problem in Perspective

Lorne Trottier

"Let us hope it is not true, but if it is, let us pray it does not become widely known." This (perhaps apocryphal) quote was supposedly made by the wife of the Archbishop Wilberforce about Darwin's theory of evolution. While interpretations vary, most take this remark to reflect her fear that science will damage people's belief in religion (at least as she viewed it). In the present context it might be used to express fear that Harris's skepticism about science will damage people's faith in science itself.

At a conference on the reproducibility of science I attended several years ago, a participant made a similar remark to that attributed to Mrs. Wilberforce. I share this concern about the credibility of the scientific enterprise in the eyes of the public. We live in a time when established science is under attack by creationists, vaccine and climate change deniers, and other purveyors of pseudoscience. The fact that the majority of published scientific studies are wrong in some way could provide a major boost to science deniers of all sorts.

Defenders of the scientific enterprise need to be prepared to put the problem of reproducibility in perspective, while working actively to improve the quality and reproducibility of research. We need to stress that science does yield reliable knowledge. Despite fits and starts, science identified the infectious agent for AIDS, developed sensitive tests for the virus (protecting countless recipients of blood transfusions), and found ways to stop the replication of the virus (allowing individuals infected with HIV to live normal lives). We have reliable knowledge that vaccines do not cause autism, Laetrile does not cure cancer, and smoking does cause lung cancer. This knowledge comes through the collective enterprise of many scientists, whose work, individually and in some respects, may be flawed. That said, scientists should work to reduce these flaws and improve scientific rigor.

Skeptics now have to confront a different kind of skepticism, against science itself, and we need to be prepared to argue our case for science.

Lorne Trottier lives outside of Montreal, Quebec, Canada.

Skeptical Inquirer
THE GOD ENGINE
HOW BELIEF DEVELOPS
James E. Alcock
Cosmos Season 2: On the Set
Nine Biological Reasons Noah's Flood Never Happened
Multi-Level Marketing Schemes
Radiation and Rationality: Facts vs. Fears
Algorithms Aren't Oracles

## The God Engine

I thoroughly enjoyed your article "The God Engine" in the September/October 2018 Skeptical Inquirer.

I felt there was one factor in author James Alcock's explications of reinforcement of religious beliefs that was not addressed enough for my liking, related to his sixth factor, group identity. I missed seeing a mention of a powerful evolutionary aspect: reproductive advantage.

Religious groups provide social interactions that may provide more mate selection opportunities, and often the religious beliefs themselves contain a directive to be fruitful. This may result in more persistence of religious beliefs because of reproductive advantage, which additionally would have a positive feedback effect producing more and more believers.

Dave Suess
Redondo Beach, California

I just re-read James Alcock's "The God Engine." His discussion of some early believers' taking a more logical view of religion, and rejecting it, as they matured, prompted a question. It seems as if there may be an age range, as with language ability, during which a person's critical thinking powers can be best developed, after which they become more and more hopeless, if they have not learned to question foolishness by then. Has anyone stated this more definitively?

Joan MacNeill
Portland, Oregon

Thank you for "The God Engine" by James E. Alcock. I enjoyed the description of how normal human thinking can make supernatural belief the automatic default. The article did not mention the role of God and religion in personal self control, especially when people try to change their own behavior. An example would be the role of spirituality and a "higher power" in twelve-step addiction programs, but this theme is also prevalent in formal religions. I would be interested in reading anything your authors have to say about this aspect of religion.

John Bunnell
Fountain Valley, California

In "The God Engine," James E. Alcock provides a welcome change from the limitations of the "God does not exist" type of discussion often found in skeptic circles. There were, however, places where I feel a broader approach would have been useful.

First, in enumerating some beliefs of a number of religions, it seemed misrepresentative to characterize Christianity as a form of cannibalism. Yes, Roman Catholicism in particular goes on about "the Body of Christ," but if we allow a matter of emphasis, the extreme R.C. position historically is trying to differentiate itself from Protestantism. In practice, the Eucharist is often regarded as a ritual meal. The eating aspect may be seen as an inadequate attempt to talk about "absorbing" Jesus in the sense of adopting Christian principles. This is still religion but not without purpose.

Second, prayer could be treated more broadly. While prayer is often described as "talking to God," it seems quite obviously "talking to oneself." To what extent might prayer, using religious language but with some problem in mind, be a form of "thinking about" where the decision making occurs subconsciously? It is religious behavior but may lead to positive results.

As to whether religion can and should be eradicated: there is much discussion to be had on the way forward, and scientific insights have a leading role to play.

Peter J. Seymour
Redhill, Surrey, United Kingdom

The fact that humans invented religion, with its premise of a supreme being that created everything and its reassurance that you never really die, has been the object of attention of many intelligent, articulate, and highly qualified analysts, who have produced many books and articles full of five-syllable words that attempt to "explain" why a lot of people "believe" in God and all the rubbish that goes with it. Alcock's complex and convoluted treatise compels my little addendum. He writes, "In conclusion, belief in the supernatural is a natural consequence of normal cognitive development ... ," which, if I am not mistaken, is a slightly pompous way of saying that we are smart enough to know we're going to die, and we suspect—and we fear—that it might mean the cessation of consciousness, forever, and to counter the unbearable knowledge of that possibility religion, in its myriad forms, with its promise of eternal life, was imagined. I truly mean no disrespect, but honestly, tomes may be written, but I really don't think it's any more complicated than that.

Gene White
Santa Fe, New Mexico

*James E. Alcock replies:*

*These are all interesting comments, but due to space limitations I can make only a brief response to each. Suess raises a good point. Reproductive advantage for the group is one of many factors that can lead to increases in the number of believers—just consider the example of the Roman Catholic Church and its ban on birth control and abortion. However, while important, reproductive advantage is not essential to the maintenance of the belief system.*

*As for MacNeill's concern, critical thinking is a complicated matter. For example, some people demonstrate excellent critical thinking skills with regard to secular matters but do not apply their analytic abilities to their supernatural beliefs. Bunnell raises an interesting point about religion, self-control, and the use of the religious concept of a "higher power" as an aid in overcoming addiction. Believing in the influence of an external agency can be appealing and effective, especially to those who lack confidence in their own abilities to effect change in themselves. Such belief in the power of an external influence is also reflected in responses to placebos and hypnotic induction.*

*With respect to Seymour's comment about cannibalism, I am simply saying that the Eucharist is unlikely to seem peculiar to someone raised as a Christian, even if one is now an apostate. However, someone not raised in that faith and lacking any deeper understanding of it may well wonder at the seeming cannibalistic nature of the ritual, just as non-Hindus may consider bizarre the ritual of rubbing clarified butter on a representation of a god's phallus.*

*Finally, in response to Gene White, an abundance of psychological research shows that supernatural belief develops long before children have any understandings of, or worries about, survival after death. While fear of death may indeed inspire adult fidelity to religious beliefs and practices, it is most certainly not the reason that such beliefs develop in the first place. Complex and convoluted or not, the finding that supernatural belief is a natural consequence of normal cognitive development is important for an understanding of how we grow up to understand the*

*world around us.*

*See also the article in this issue by Gregory S. Paul and James Alcock's extended response following it, pp. 42–49.—Editor*

## Rethinking Radiation and Nuclear Power

The article by Jeanne Goldberg is an essential contribution, not just on unjustified fears related to radiation but on the role of nuclear energy in climate change mitigation ("From the Spectral to the Spectrum: Radiation in the Crosshairs," September/October 2018).

Anti-nuclear paranoia has been the principal reason for the failure of climate change policy over the past decades. In Germany, the populist decision of the government to phase out of nuclear power has kept emissions high with Germany failing all its set targets. Germany, as some other regions of the world, continues to uphold the 100 percent renewable illusion.

A major part of the problem is that too many climate scientists, unlike climate science pioneer James Hansen, have joined the anti-nuclear bandwagon and put their belief in a completely unsubstantiated 100 percent renewable future. We have come to a climate orthodoxy that goes well beyond climate science per se and encompasses other fields.

Climate scientists have correctly challenged denialists because accomplished scientists in other fields make sweeping claims beyond their field of expertise. However, strangely some prominent and competent climate scientists in Germany do not realize that they are doing the same when it comes to topics that they are not expert in. They oppose nuclear power as an obvious mitigation strategy because of alleged risks that are blown entirely out of proportion. They also talk about a 100 percent renewable future without the slightest idea of how energy systems operate. Some generally good websites on climate science have even abandoned critical thinking on nuclear power and renewable energy by feeling obliged to defend an indefensible belief system on the only mitigation path promoted by a partisan community.

I laud the Skeptical Inquirer for giving a voice to Jeanne Goldberg, who as a radiologist has precisely the kind of solid background needed when talking about the claimed dangers of radiation. She has brought us to ground reality far from the anti-nuclear scaremongering we have all become accustomed to. We need the advice of the real experts in each of the relevant fields if we want to address climate change seriously.

Amardeo Sarma
Chairman, GWUP
(German skeptics)
Rossdorf, Germany

Jeanne Goldberg's excellent article on radiation is marred by reference to Chernobyl and Fukushima as "disasters" (the latter twice). A disaster typically kills very large numbers of people. As Goldberg says, none of the Fukushima workers who died were killed by radiation, and no deaths or cases of radiation sickness could be documented, but more than 100,000 people were needlessly evacuated, causing more than 1,000 deaths, and suicide rates increased. As for Chernobyl, about thirty people were killed more or less instantly by the explosion (*not* a nuclear explosion) and another thirty or so died as a result of the initial intense radiation. There is no evidence that anyone else at all has died as a result of the accident. Certainly, Chernobyl was tragic and should never have happened, but it would have attracted far less attention and would now almost certainly be forgotten if it hadn't involved radiation. An appropriate comparison would perhaps be with the thousands killed in Chinese coal mines every year, attracting almost no attention.

One of the greatest tragedies of our time is that the first most people heard of nuclear energy was its use in weapons, leading to the belief that radiation is something alien and sinister. It is depressing to read that over 70 percent of Americans think all radiation results from human activity rather than being a fundamental part of the nature of the universe. As Theodore Rockwell, quoted by Goldberg, says, we "live in a sea of natural radioactivity." A trip to Cornwall, England, would give you a bigger dose than all the radiation ever released by human activity, either intentionally (nuclear weapons) or unintentionally (accidents), and eating a big banana would result in about the same dose as going through a full body scanner at an airport!

Ray Ward
London, United Kingdom

I read with interest Jeanne Goldberg's "Radiation in the Crosshairs." The articles referenced were all "recent"—the earliest dated 1998. My mother, Miriam Finkel, PhD, published a paper in 1958 in *Science* 128 (3338): 1580–1585. That paper was a survey of her radiation research from the 1944 Manhattan Project to the then-current 1958. In that paper she wrote that her research showed that the dose-response curve was *not* linear; a small amount of radiation is not harmful. This paper was very controversial in 1958, and today there are still researchers who believe in a linear dose-response curve.

Barry S. Finkel
Chicago, Illinois

*Jeanne Goldberg replies:*

*Amardeo Sarma provides a clear description of how anti-nuclear paranoia in Germany has eliminated nuclear energy as a promising tool to address climate change. He points out that even many climate scientists inappropriately oppose nuclear power in favor of attempts to achieve a 100 percent renewable energy future, likely an impossible goal. The recent release of the latest Intergovernmental Panel on Climate Change report was indeed timely and sends a strong message that there is an urgent need to address climate change. Nuclear energy plant installations require large up-front capital expenditures but certainly would offer the safest, most efficient method to provide energy for a rapidly expanding global population. We need to address the anti-nuclear paranoia that Sarma refers to in his letter. Nuclear energy mitigation strategy needs to be placed back on our radar screens.*

*Ray Ward states that the word* disaster*, referring to Chernobyl and Fukushima, is inappropriate due to the fact that this term usually applies to events or accidents where large numbers of people are killed. He makes an excellent point that these two accidents attracted attention largely because they involved radiation, regarded with fear by the public, whereas the thousands of Chinese workers who die in coal mines each year escape notice.*

*Barry S. Finkel's letter is fascinating, referring to published research that his mother performed in the 1950s, disputing the LNT (linear no-threshold) radiation risk model. Despite not having access to our modern molecular and cellular radiobiological data, her controversial conclusion, based on her studies, is largely supported in scientific, if not regulatory, circles today.*

## Advocating Science to Religious Believers

The commentary by Davidson, Hill, and Wolgemuth recommends that the way to persuade creationist believers to give up that belief is to use persuasion from those who understand science but prefer to remain Christian ("We Need a Paradigm Shift for Science Advocacy," Septem-

ber/October 2018).

As a marketing strategy this is probably useful, on the basis that science with mild Christianity is less dangerous to society than is unadulterated creationism. But does the combination of science with mild Christianity produce a workable tool for this purpose? For someone who fails to understand the illogicality built into this combination it may work, as it has for many who were brought up in that belief. But does it work for someone with creationist beliefs? Even doing only this requires destroying creationist beliefs. Might it not be more effective to persuade by applying the incompatibility of religious belief with that of scientific knowledge? Thus doing the larger job but with a bigger weapon.

Destroying religious belief does not necessarily result in nihilism. A close relative of mine is trying to persuade me to start enjoying life by adopting her Catholicism and, it seems, adopting what she considers guilt. I wrote to her:

> There is no evidence that any supernatural objects exist in our universe. The arguments for such have been disproved. If such exist outside our universe, then they are irrelevant to us. The fact that mankind are social animals with the power of speech provides a reason why mankind invents gods. So, why bother with concepts that have no objects?
>
> Does this absence of supernatural objects, gods and such, imply that life is worthless? In one sense it does: the universe doesn't care for the human race. But in another sense it doesn't: human beings live in a web of life, loving and learning from parents, relatives, and society, and passing love and learning onto the children of all of these. I've nearly finished playing my part in this story, and I am satisfied that, despite my faults, my contribution has, on balance, been worthy. [I am eighty-eight years old] Rather short and to the point. One can, for anyone, consider their life as a series of acts, some good and some bad, but what I have written in the previous sentences covers the essential point about the value of life: life is valued as part of the history of society.

John Forester
Lemon Grove, California

Davidson, Hill, and Wolgemuth are right. Skeptics need new approaches that take advantage of more accurate understandings of the American population.

We devote resources to combating Christianity, supporting political efforts to prevent Christians from practicing their values publicly. I have personally engaged in formal creation debates because that is my competence. But on a personal level I've had more results from reminding Christians that most atheists are liberal atheists and the rudeness comes from the liberalism, not the atheism.

To me it is obvious that New Age is the ascendant and more relevant religion we should target. It is the religion of the young. Its followers are more illogical than the most ignorant of Christians. It is threatening public health and hindering economic growth. Five hours a night, 365 nights a year there is a program on national radio promoting New Age nonsense of every imaginable stripe. No Christian preacher in American history ever had such an audience. I constantly send in corrections and refutations. Perhaps dozens of other skeptics do. There should be thousands. When, rarely, skeptics appear as guests on the program their preparation and presentation often leave something to be desired. This is inexcusable.

Why can't we produce podcasts and videos that consistently exhibit professionalism, production values, and courtesy rather than self-indulgence or immature vulgarity and condescension? How is that working for us?

Norman Carlson
Busti, New York

Publications such as the Grand Canyon book mentioned and the recent *God's Word or Human Reason* book on evolution written by a similar group can be persuasive and useful to those willing to accept evidence other than revelation.

It is a good idea to downplay aggressive confrontation. However, it is difficult to do this when it is basic to science that evidence matters while many on the contrary side admit that no evidence from science or history will sway them. Whatever the real extent to which the "faith trumps all evidence" is prevalent in the United States, I foresee little gains to be made in that portion of the population. Even religious people who don't agree with their sectarian beliefs have been labeled as "not real Christians."

Literalistic interpretations of biblical passages, and additional corollaries drawn from them, are contradicted by the observations made and conclusions drawn by geologists, biologists, paleontologists, astronomers, and cosmologists. None of the anti-evolution, young-earth, and Noah's-Flood-really-happened posts I've read on the web are based on what scientists would recognize as a preponderance of evidence. They are a pretend scientific justification for those alt-history beliefs.

I don't see how anyone with contrary ideas can establish rapport with such people.

Robert Rettke
Lake Charles, Louisiana

*Authors Gregg Davidson et al. reply:*

*We are glad to learn that our contribution to* Skeptical Inquirer *was read and engaged. We heartily agree with one reader who advocated for more civil discourse between those of differing world-views. Respondents shared a common misgiving about using religious scientists to reach members of their own faith traditions, suggesting (or insisting) that science and religion are inherently at odds, and therefore a more honest or more effective approach is to attack the roots of religion itself. Given adequate space, we might take issue with the presuppositional belief that science precludes any action of the divine, though that would likely require a full essay. We could also challenge the misperception that reconciling science and Christian faith requires a watered-down religious view—another essay. Instead, we will make just one observation that is more directly relevant to the point of our article.*

*Justified or not, equating modern scientific understanding with materialism validates popular suspicion that secular scientists are not motivated by what they find in nature but rather by a philosophical agenda. This effectively vaccinates the religious public from even considering the scientific evidence. If the one delivering the message is not considered trustworthy, the evidence gets ignored. In contrast, when the same evidence is presented by someone who affirms religious beliefs, we have seen many Christian believers not only consider the scientific evidence but embrace it. If this is not considered a win by science advocates across the board, one has to ask what the objective is.*

## Challenging Homeopathy

In the September/October issue, Kendrick Frazier describes comparison tests of *high-potency* homeopathic preparations that a German skeptic group plans to conduct.

I think that uninformed readers will be greatly confused by the term *high potency*. Homeopaths use the term to describe a treatment that has great effect, whereas a scientist would consider it the weakest possible strength. This is because the greater the dilution of the active ingredient, the higher the potency they claim! So if the German test is to distinguish between various high potency remedies, the subjects will be comparing samples consisting of more or less pure solvent, probably quite difficult.

For those not familiar with homeopathy, a remedy is considered high-potency if it has a dilution of the active ingredient of 30C ($1/100^{30}$) or more. For comparison, a pinch of salt in the ocean would be about a 12C ($1/100^{12}$) dilution. Oscillococcinum cold remedy has a 200C ($1/100^{200}$) dilution (unachievable, since there are estimated to be only $100^{80}$ atoms in the universe). The Cold-Eze cough remedy has a dilution of 2X ($1/10^{2}$); equivalent to 1C. Yet the box of both products states that they are homeopathic. The latter can definitely be bioactive, whereas the former is certainly not (assuming that the solvent is absolutely pure). Thus, *homeopathic* is a term of marketing art, not one of science.

Raoul Drapeau
Ashburn, Virginia

Homeopathy's fraudulent, unscientific nature was challenged in the United States, India, and the United Kingdom with prize money. No one would come forward. Where they did, it was total failure. James Randi and Abraham Kovoor (in India) withdrew the challenge amount after waiting for decades. The British government is withdrawing its financial support to homeopathy. Good. Where homeopathy is supported by some prominent persons, including press people, they fail to undergo homeopathy treatment; they opt for scientific medicine when they are personally affected!

The only way is to insist that homeopathy prove its credibility by accepting scientific methods. I have not come across anywhere in the world where homeopathy has undertaken even a scientific survey of their results. It is notoriously populistic make believe.

Innaiah Narisetti
Brookeville, Maryland

*We asked GWUP's Norbert Aust to comment on Drapeau's letter. He replied, in part:*

*In Germany we consider every homeopathic potency above 24X or 12C as high potency, at least we skeptics do, because from those points onward the original mother tincture is completely washed out. So we set this as a threshold for the minimum potency to be tested and refer to this as "high potency." In our understanding, and Raoul is right here, high potencies do not contain any particle of the original mother tincture. Even when homeopaths agree to that fact, they insist they are able to achieve effects determined by the nature of this mother tincture. They spend a lot of effort to establish if, for instance,* Apis mellifica *30C,* Natrium muriaticum *30C, or* Arsenicum album *30C is the proper remedy for the patient. If they would prescribe the wrong one it would be useless for the recovery of the patient … . Prove us wrong, show us that homeopathy might have some basis in reality after all and earn € 50,000. Thus, we made it as attractive as we could for homeopaths to join in.*

## Creating an Apparition

The September/October issue of Skeptical Inquirer contains a three-page special report ("Ghostly 'Black Monk' or Random Tourist?") responding to newspaper accounts of the appearance, in a photograph of a castle in Kent, of a hooded figure that the photographer does not recall noticing when he took the picture and which he therefore believes to be supernatural. That article may be an over-reaction to a minor observation; British ecclesiastical ruins are prime sites for more direct spectral encounters.

Several decades ago my wife and I visited the massive ruin of Fountains Abbey in Yorkshire with our two teenage daughters. The day was overcast and there had been occasional showers. As the closing hour approached, we and a busload of middle-aged German ladies were among the few visitors remaining.

Suddenly one of the bus ladies gasped and pointed out through a window opening. Some distance away two hooded figures, palms piously pressed together before reverently bowed heads, drifted across the field of view. From the excited comments of the tourists, it seems likely that many long Teutonic winter evenings for years to come would be enlivened by Grandma's tales of that apparition of medieval nuns at a ruin in England.

Our daughters did not view the apparition, having temporarily disappeared, wearing dark hooded raincoats, a short time earlier.

Daniel Atkinson
Medford, Oregon

## Readers' Myopia on Pinker

Regarding the reader comments (Letters to Editor, September/October 2018) on Steven Pinker's earlier article, "Progressophobia": Do you hear yourselves? "I hate what the world has become in my lifetime." "I can't accept his statements because they directly contradict my long experience." "The situation now is worse than any I have seen in my lifetime." Friends, your myopia is showing!

Before us stands the epitome of a true man of science whose contributions are of the highest quality in terms of thorough research and addressing views from all relevant perspectives, including those expressed by you. If I were king, *The Better Angels of Our Nature* and *Enlightenment Now* would be required reading for every adult on the planet.

And so, I want to challenge you to read one or both of these books and then express your disagreements. Any supporter of science and skepticism will recognize Pinker's profound contribution, with little doubt that he has handled the subject skillfully, thoroughly, and thoughtfully. I am deeply grateful that Professor Pinker has decided to compile and share such knowledge and insight with me.

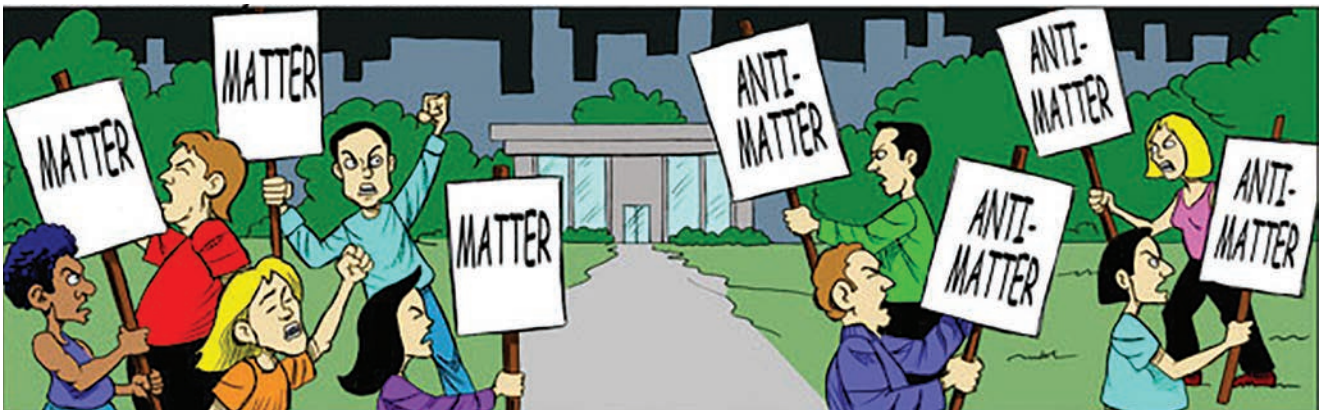
One letter writer accused Pinker of wearing rose-colored glasses. No, sir: Steven Pinker is wearing those amazing spectacles provided by science. If you are using the same prescription, it's time you cleaned your lenses.

Joseph DeRosa
Reno, Nevada

## [FEEDBACK

The letters column is a forum on matters raised in previous issues. **Letters should be no longer than 225 words**. Due to the volume of letters we receive, not all can be published. Send letters as email text (not attachments) to letters@csicop.org. In the subject line, provide your surname and informative identification, e.g.: "Smith Letter on Jones evolution article." Include your name and address at the end of the letter. You may also mail your letter to the editor to 944 Deer Dr. NE, Albuquerque, NM 87122.

**Future Shock by Jim & Pat McGreal**

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**Future Shock by Jim & Pat McGreal**

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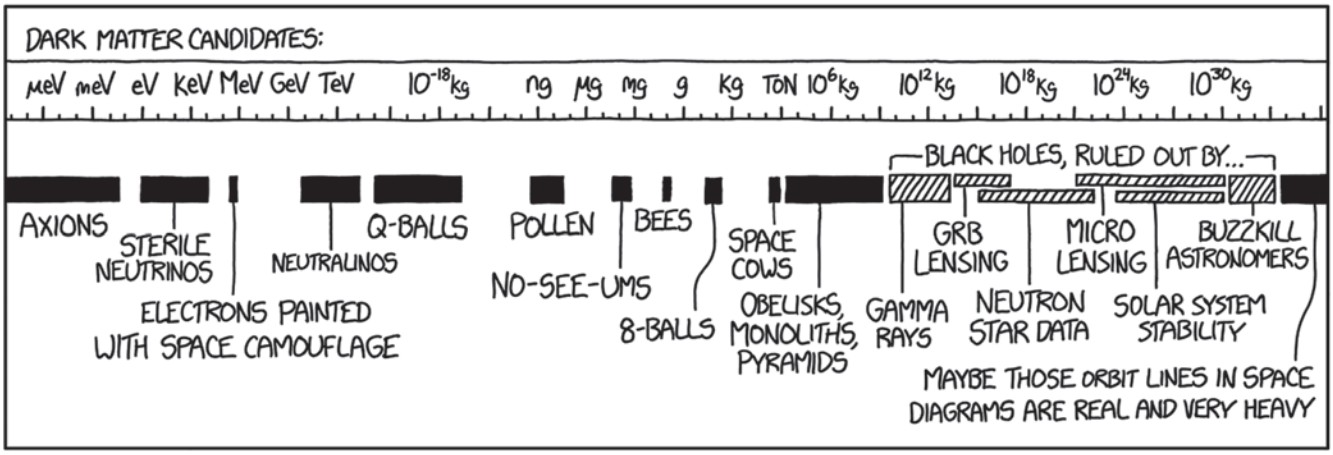
**XKCD: Dark Matter Candidates**




www.xkcd.com

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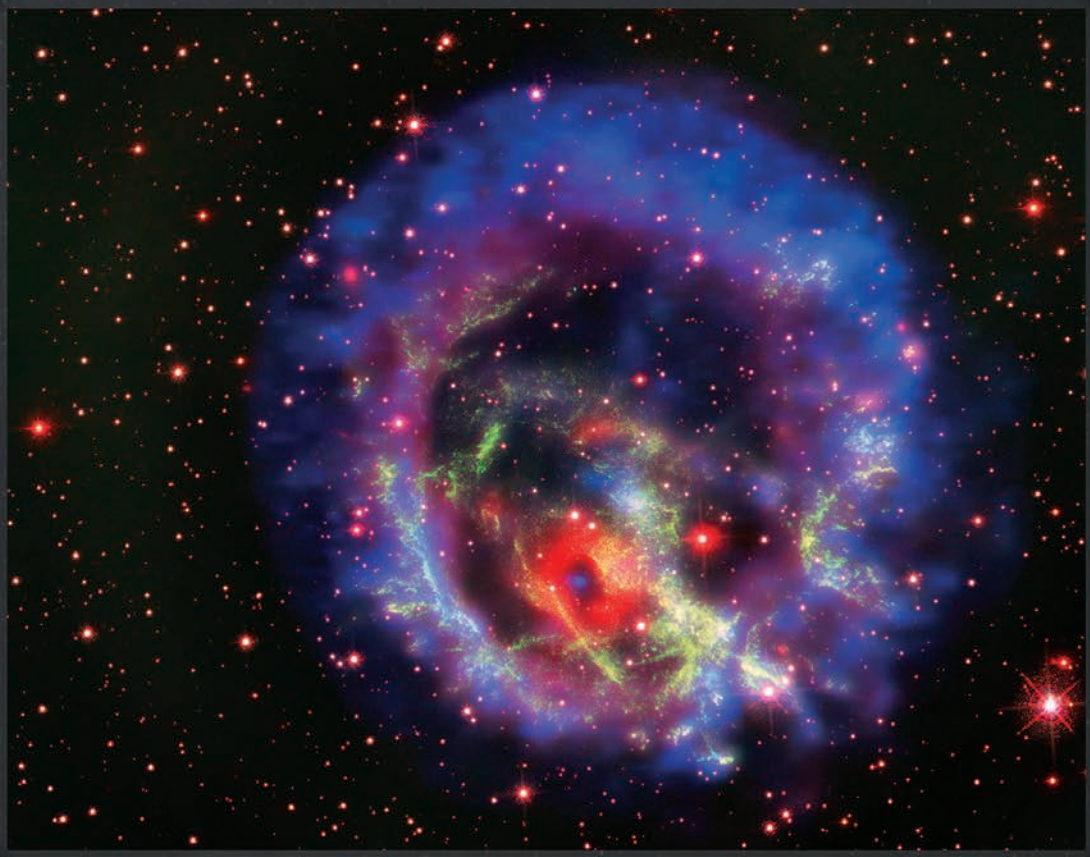
# The Lonely Neutron Star in Supernova Remnant E0102-72.3



Astronomers have discovered a special kind of neutron star for the first time outside of the Milky Way galaxy. It is within the debris left over from an old supernova explosion, shown here. The "lonely neutron star" in question is the blue dot at the center of the red nebula near the bottom left of E0102-72.3. In this composite image, blue represents X-ray light captured by NASA's Chandra Observatory; red and green represent optical light captured by ESO's Very Large Telescope in Chile and NASA's Hubble Space Telescope in orbit. The neutron star and supernova remnant are in the Small Magellanic Cloud, a small neighbor galaxy 200,000 light-years from Earth.

CREDIT: X-ray (NASA/CXC/ESO/F.Vogt et al); Optical (ESO/VLT/MUSE & NASA/STScI)